Reach Drive User Manual

Manufactured for DBT

Instruction Manual D2-3561

Rockwell Automation

The information in this manual is subject to change without notice.

Throughout this manual, the following notes are used to alert you to safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: The drive can operate at and maintain zero speed. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or may operate at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Do not install modification kits with power applied to the drive. Disconnect and lock out incoming power before attempting such installation or removal. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

ATTENTION: The drive contains ESD- (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing the drive. Erratic machine operation and damage to, or destruction of, equipment can result if this procedure is not followed. Failure to observe this precaution can result in bodily injury.

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

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CHAPTER 1
Introduction

The purpose of this manual is to provide you with the basic information needed to install, start-up, and troubleshoot the Reach Drive.

1.1 Who Should Use this Manual?

This manual is intended for qualified personnel. You must be able to program and operate adjustable frequency AC drives devices. In addition, you must have an understanding of the parameter settings and functions.

1.2 Manual Conventions

Parameter names: In most instances, parameter names are shown as the parameter name followed by the parameter number.

For example: Ramped Speed (22).

1.3 Identifying the Drive by Nameplate

Each Reach Drive can be identified by its nameplate.

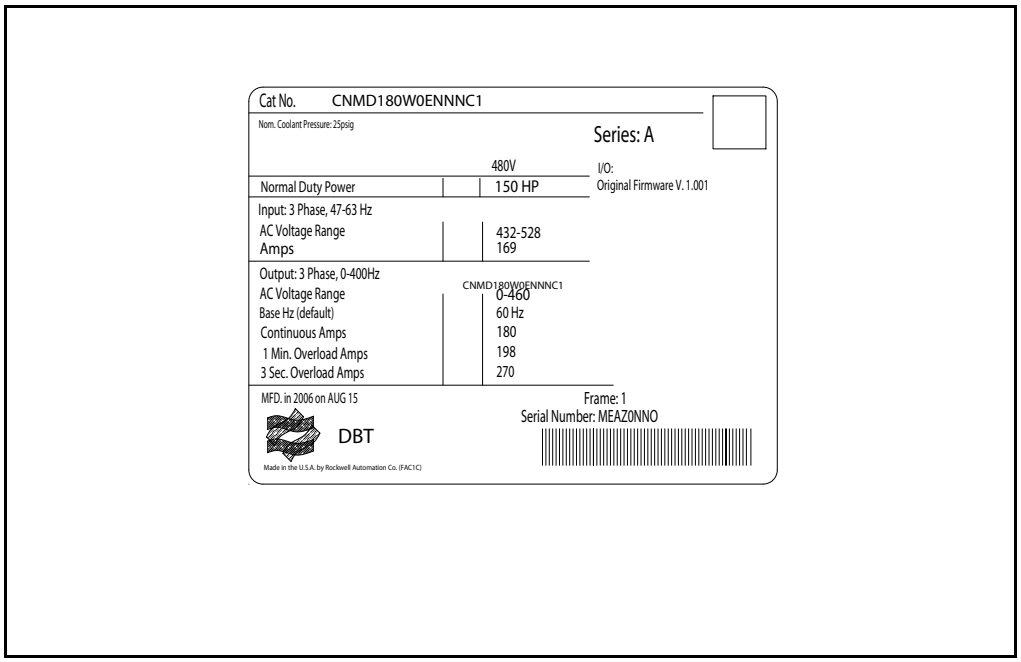


Figure 1.1 – Identifying the Drive by Nameplate

1.4 Identifying the Drive by Model Number

Each Reach Drive and Reach Drive Kit can be identified by its model number. The model number is on the shipping label and drive nameplate. The model number includes the drive and any factory-installed options.

Table 1.1 – Reach Drive Model Numbers

Part	Model Number
Reach Drive	CNMD180W0ENNNC1
ControNet Comm Adapter Fiber Kit	CNM-CNETGF-11
Pump Control Adapter Kit	CNM-PCTRL-11
Dynamic Brake Resistor Kit	CNM-R2-019P600

CHAPTER 2
Installation/Wiring

This chapter provides information on mounting and wiring the Reach Drive.

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All items must be read and understood before the actual installation begins

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

2.1 AC Supply Source Considerations

Reach Drives are suitable for use on a circuit capable of delivering up to a maximum of 200,000 rms symmetrical amperes and a maximum of 600 volts.

ATTENTION: To guard against personal injury and/or equipment damage caused by improper fusing or circuit breaker selection, use only the recommended line fuses/circuit breakers specified in Appendix A.

If a system ground fault monitor (RCD) is to be used, only Type B (adjustable) devices should be used to avoid nuisance tripping.

2.1.1 Unbalanced or Ungrounded Distribution Systems

ATTENTION: Power distribution to Reach Drives is intended to be from the ungrounded secondary of the system's step down transformer. Protective MOVs, the EMI Snubber Board, and common mode capacitors (3 places) in the drive have been disconnected. They should typically be reconnected in any application where the power distribution at the drive is grounded. Refer to Figure 2.1

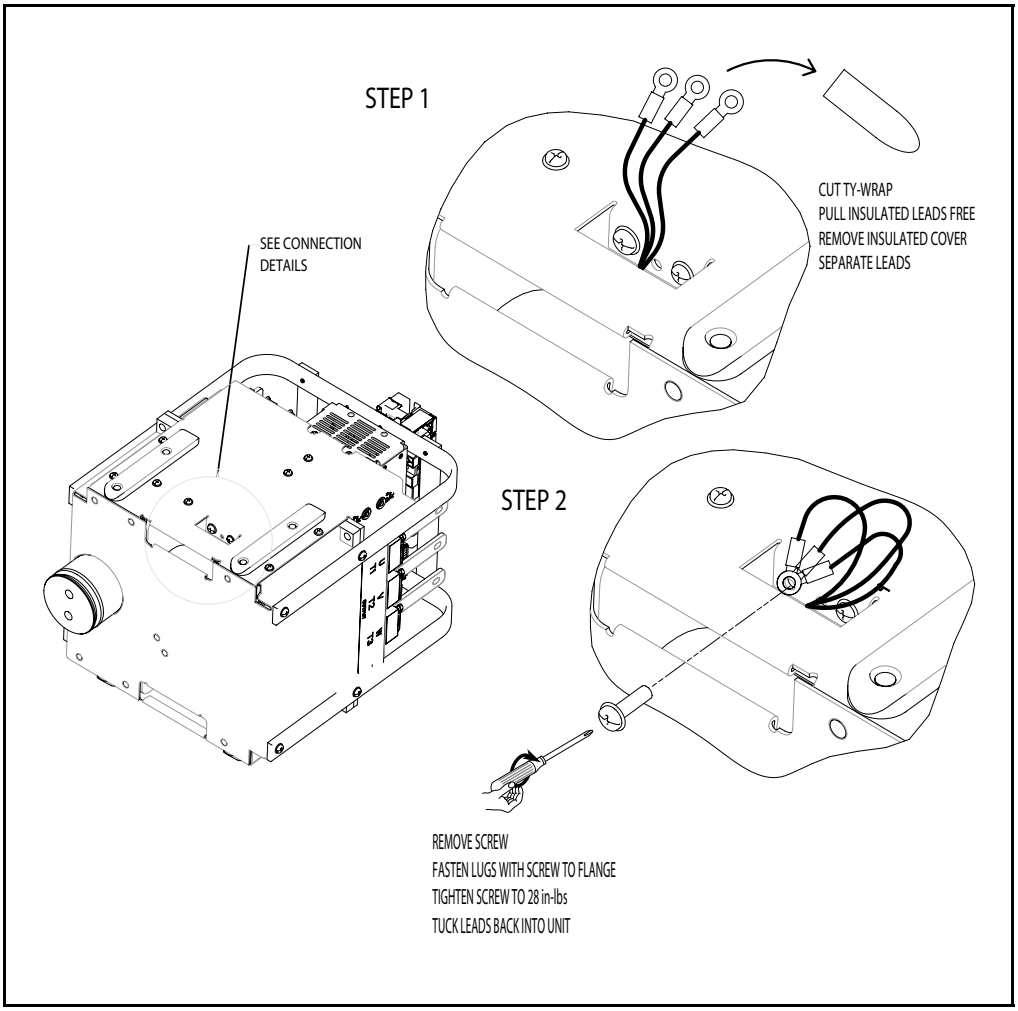


Figure 2.1 – Protective Circuit Connections for Grounded Drive Systems

2.1.2 Input Power Conditioning

Certain events on the power system supplying a drive can cause component damage or shortened product life. The following events can cause such damage.

- The power system has power factor correction capacitors switched in and out of the system, either by the user or by the power company.
- The power source has intermittent voltage spikes in excess of 6000 volts. These spikes could be caused by other equipment on the line or by events such as lightning strikes.

- The power source has frequent interruptions.

If these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer or reactor.

2.2 General Grounding Requirements

The drive Safety Ground - PE must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be periodically checked.

For installations within a cabinet, a single safety ground point or ground bus bar connected directly to building steel should be used. All circuits including the AC input ground conductor should be grounded independently and directly to this point/bar. Refer to Figure 2.2 and Table 2.1.

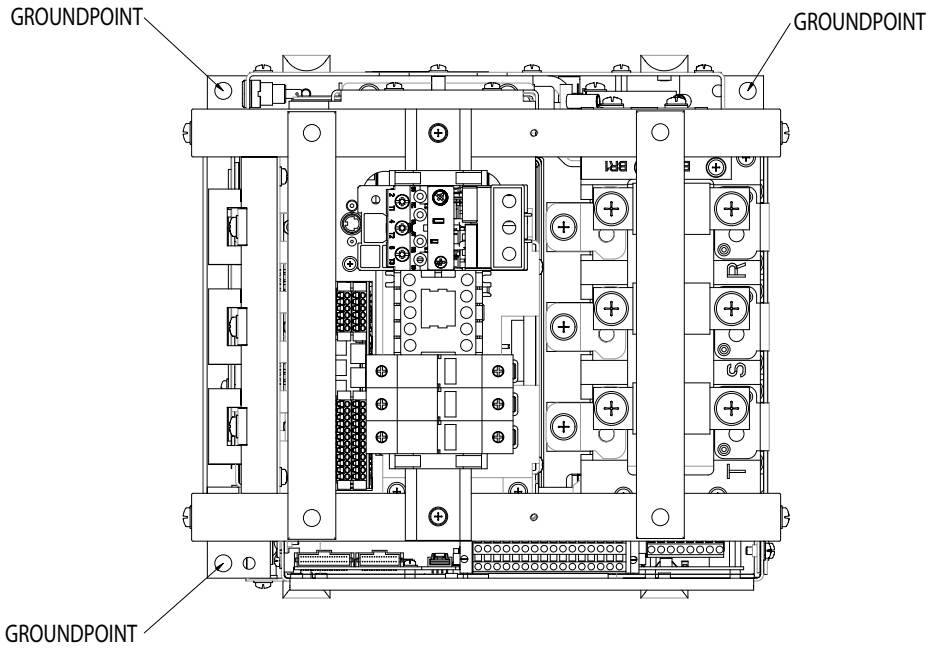


Figure 2.2 – Recommended Ground Locations

Table 2.1 – Power Termination Locations Notes

Terminal	Description	Notes
BR1	DC Brake (+)	DB Resistor Connection
BR2	DC Brake (-)	
DC+	DC Bus (+)	
DC-	DC Bus (-)	
PE	PE Ground	
⏚	Motor Ground	
U	U (T1)	To motor
V	V (T2)	To motor
W	W (T3)	To motor
R	R (L1)	AC Line Input Power
S	S (L2)	AC Line Input Power
T	T (L3)	AC Line Input Power
PS+	AUX (+)	Auxiliary Control Voltage
PS-	AUX (-)	Auxiliary Control Voltage

2.2.1 Safety Ground - PE

This is the safety ground for the drive that is required by code. This point must be connected to adjacent building steel (girder, joist), a floor ground rod or bus bar (see above). Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

2.2.2 Shield Termination - SHLD

The Shield terminal provides a grounding point for the motor cable shield. The **motor cable** shield should be connected to this terminal on the drive (drive end) and the motor frame (motor end). A shield terminating cable gland may also be used.

When shielded cable is used for **control and signal wiring**, the shield should be grounded at the source end only, not at the drive end.

2.2.3 RFI Filter Grounding

Using an optional RFI filter may result in relatively high ground leakage currents. Therefore, the **filter must only be used in installations with grounded AC supply systems and be permanently installed and solidly grounded** (bonded) to the building power distribution ground. Ensure that the incoming supply neutral is solidly connected (bonded) to the same building power distribution ground. Grounding must not rely on flexible cables and should not include any form of plug or socket that would permit inadvertent disconnection. Some local codes may require redundant ground connections. The integrity of all connections should be periodically checked. Refer to the instructions supplied with the filter.

2.3 Fuses and Circuit Breakers

The Reach Drive includes input fuses. National and local industrial safety regulations and/or electrical codes may determine additional requirements for these installations. Refer to Appendix A for recommended fuses/circuit breakers.

ATTENTION: The Reach Drive does not provide branch short circuit protection. Specifications for the recommended fuse or circuit breaker to provide protection against short circuits are provided in Appendix A.

2.4 Power Wiring

ATTENTION: National Codes and standards (NEC, VDE, BSI etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

2.4.1 Cable Types Acceptable for 200-600 Volt Installations

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 meters (1 foot) for every 10 meters (32.8 feet) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4mm/0.015 in.). Use Copper wire only. Wire gauge requirements and recommendations are based on 75 degrees C. Do not reduce wire gauge when using higher temperature wire.

Unshielded
THHN, THWN or similar wire is acceptable for drive installation in dry environments provided adequate free air space and/or conduit fill rates limits are provided. **Do not use THHN or similarly coated wire in wet areas**. Any wire chosen must have a minimum insulation thickness of 15 Mils and should not have large variations in insulation concentricity.

2.4.2 Motor Cable Lengths

Typically, motor lead lengths less than 91 meters (300 feet) are acceptable.

2.4.3 Power Termination Location Notes

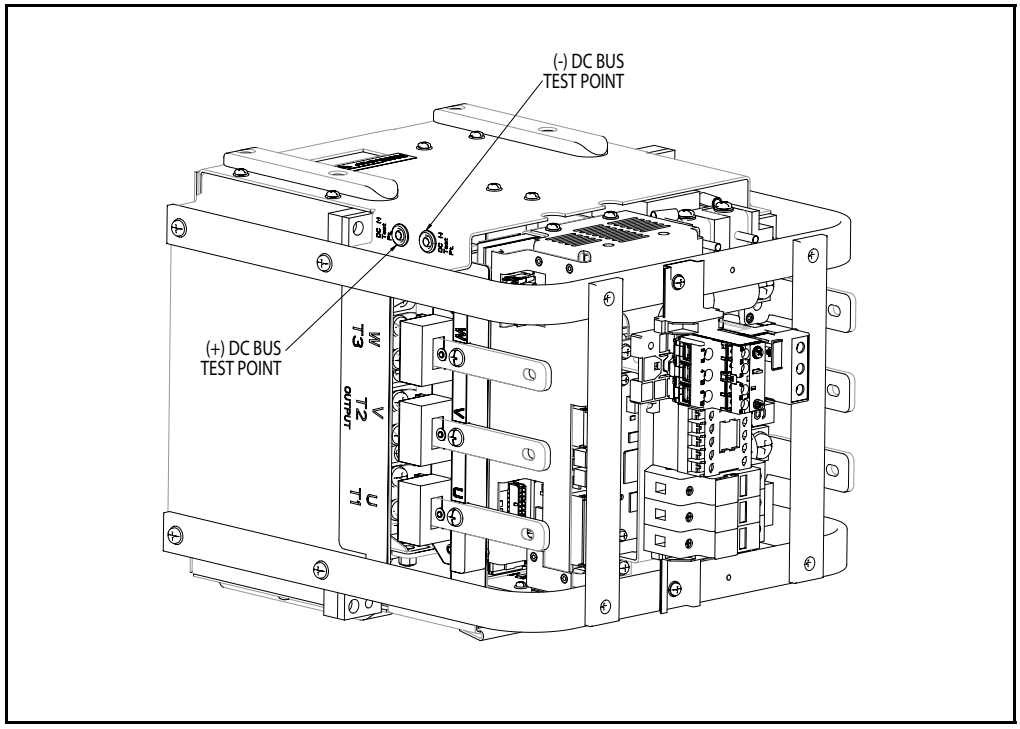


Figure 2.3 – Power Termination Locations (DC+ and DC-)

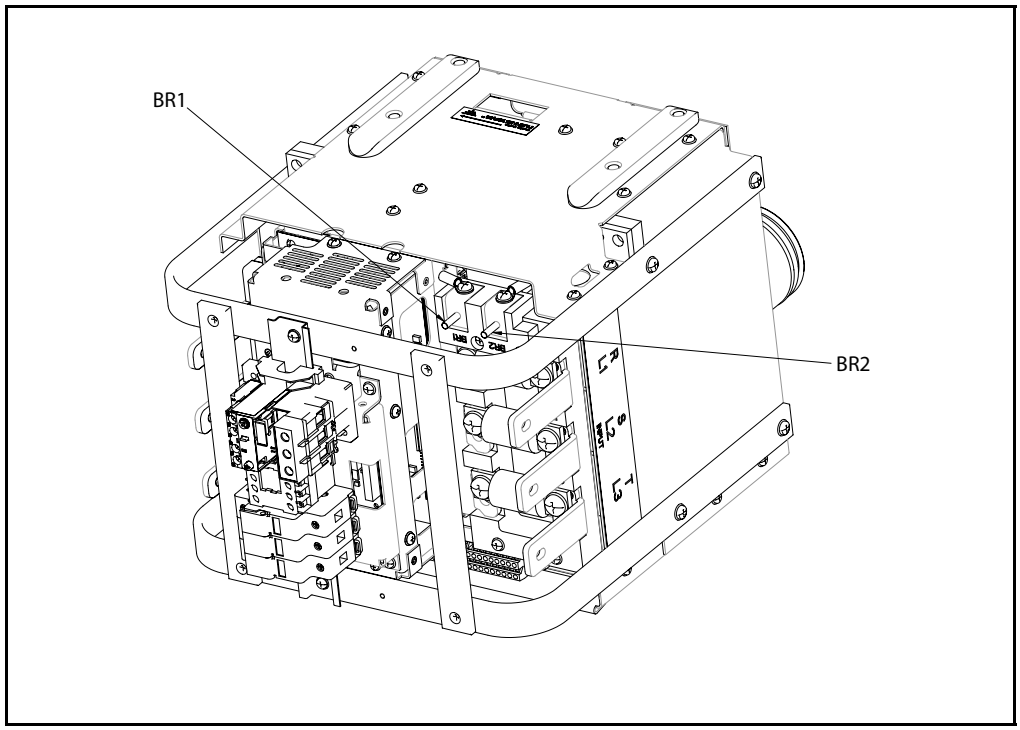


Figure 2.4 – Power Termination Locations (BR1 and BR2)

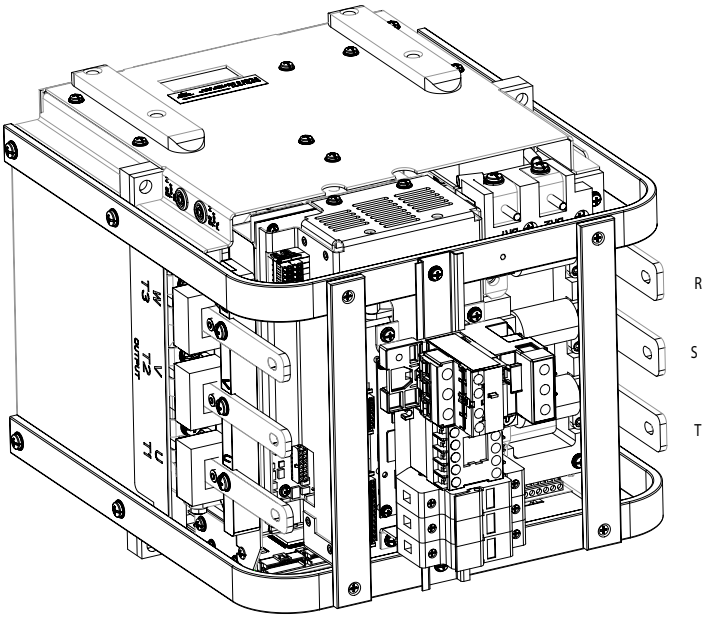


Figure 2.5 – Power Termination Locations (U, V, W, R, S, T)

2.5 I/O Wiring

Important points to remember about I/O wiring:

- Use Copper wire only. Wire gauge requirements and recommendations are based on 75 degrees C. Do not reduce wire gauge when using higher temperature wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).

Important: I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Configuring an analog input for 0-20mA operation and driving it from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

2.5.1 I/O Terminal Designations

Table 2.2 – I/O Terminal Designations

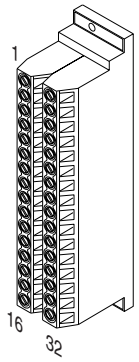
No.	Signal	Factory Default	Description	Rel. Param.
				
1	Analog In 1 (-)[1]	[2]	Isolated[3], bipolar, differential +/- 10V/4-20mA, 11 bit and sign, 88k ohm input impedance. For 4-20mA, a jumper must be installed at terminals 17 and 18 (or 19 and 20).	320-327
2	Analog In 1 (+)[1]			
3	Analog In 2 (-)[1]			
4	Analog In 2 (+)[1]			
5	Port Common	-	For (+) and (-) 10V port references.	
6	Analog Out 1 (-)	[2]	Bipolar (current output is not bipolar), +/- 10V/4-20mA, 11 bit and sign, voltage mode - limit current to 5 mA. Current mode - maxz load resistance is 400 ohms.	340-347
7	Analog Out 1 (+)			
8	Analog Out 2 (-)			
9	Analog Out 2 (+)			
10	HW PTC Input 1	-	1.8k ohm PTC, Internal 3.32k ohm pull-up resistor	238 259
11	Digital Out 1 - N.C.[4]	Fault	Max. Resistive Load: 240V AC/30V DC -- 1200VA, 150W Max. Current: 5A, Min. Load 10mA Max. Inductive Load: 240V AC/30V DC - 840VA, 105W Max. Current: 3.5A, Min. Load: 10mA	380-391
12	Digital Out 1 Common			
13	Digital Out 1 - N.O.[4]	NOT Fault		
14	Digital Out 2 - N.C.[4]	NOT Run		
15	Digital Out 2/3 Com			
16	Digital Out 3 - N.O.[4]	Run		

Table 2.2 – I/O Terminal Designations

No.	Signal	Factory Default	Description	Rel. Param.
17	Current In Jumper[1] - Analog In 1		Placing a jumper across terminals 17 and 18 (or 19 and 20) will configure that analog input for current. (Parameter 320 must be set ON.)	
18				
19	Current In Jumper[1] – Analog In 2			
20				
21	–10V Pot Reference	–	2k ohm minimum load.	
22	+10V Pot Reference	–		
23	HW PTC Input 1	–	See above	
24	+24VDC[5]	–	Drive supplied logic input power. [5]	
25	Digital In Common	–		
26	24V Common(5)	–	Common for internal power supply.	
27	Digital In 1	Stop - CF	115V AC, 50/60 Hz - Opto isolated Low State: less than 30V AC High State: greater than 100V AC 24V DC - Opto isolated Low State: less than 5V DC High State: greater than 20V DC 11.2 mA DC	361-366
28	Digital In 2	Start		
29	Digital In 3	Auto/Man.		
30	Digital In 4	Speed Sel 1		
31	Digital In 5	Speed Sel 2		
32	Digital In 6/Hardware Enable	Speed Sel 3		

[1] **Important:** 4-20mA operation requires a jumper at terminals 17 and 18 (or 19 and 20). Drive damage may occur if jumper is not installed.

[2] These inputs/outputs are dependant on a number of parameters (see “Rel. Param.).

[3] Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

[4] Contacts in unpowered state. Any relay programmed as Fault or Alarm will energize (pick up) when power is applied to drive and deengergize (drop out) when a fault or alarm exists. Relays selected for other functions will energize only when that condition exists and will deenergize when condition is removed.

[5] 150mA maximum load. Not present on 115V versions.

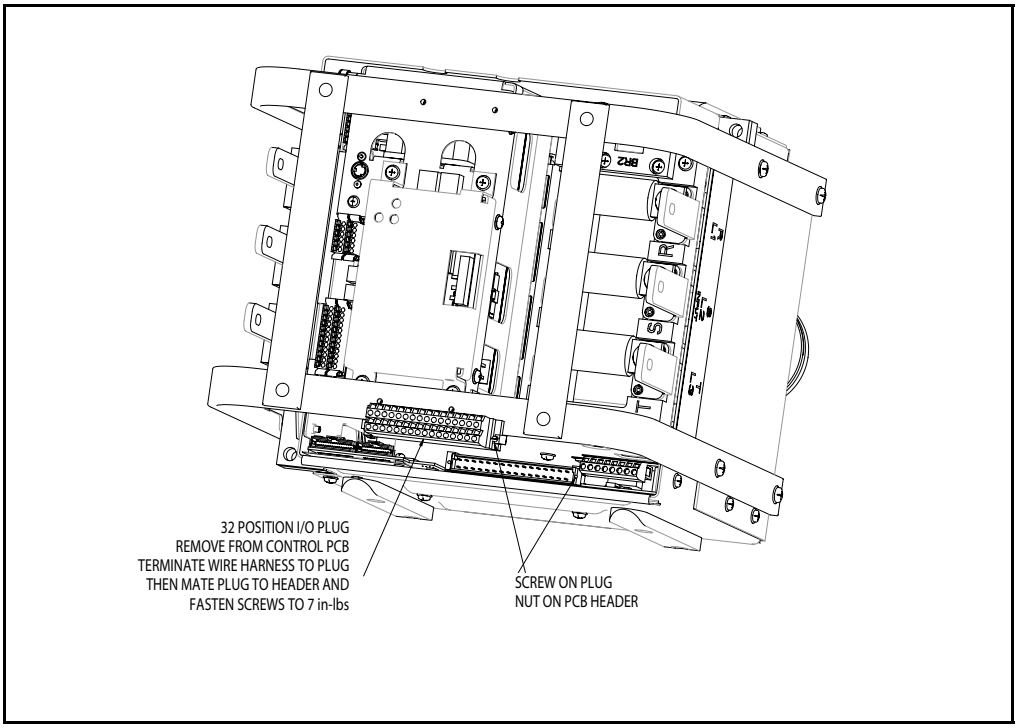
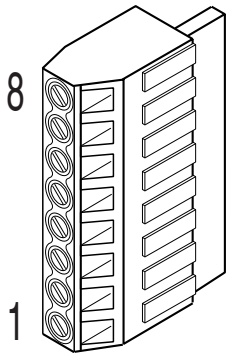

32 POSITION I/O PLUG
REMOVE FROM CONTROL PCB
TERMINATE WIRE HARNESS TO PLUG
THEN MATE PLUG TO HEADER AND
FASTEN SCREWS TO 7 in-lbs
SCREW ON PLUG
NUT ON PCB HEADER

Figure 2.6 – I/O Plug

2.5.2 Encoder Terminal Block

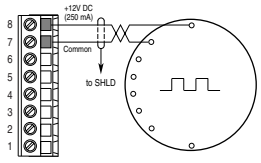
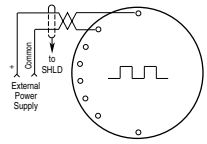
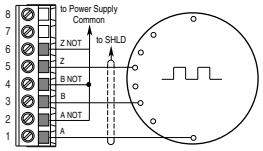
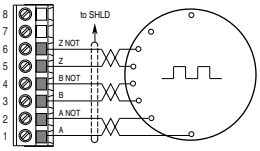
Table 2.3 – Encoder Terminal Designations



No.	Description	
8	+12V[1] DC Power	Internal power source 250 mA.
7	+12V<Footnote>(1) DC Return (Common)	
6	Encoder Z (NOT)	Pulse, marker or registration input.[2]
5	Encoder Z	
4	Encoder B (NOT)	Quadrature B input.
3	Encoder B	
2	Encoder A (NOT)	Single channel or quadrature A input.
1	Encoder A	

1. Jumper selectable +5/12V is available on 20B-ENC-2 Encoder Boards only.
2. Z channel can be used as a pulse input while A & B are used for encoder.

Table 2.4 – Sample Encoder Wiring

I/O	Connection Example	I/O	Connection Example
Encoder Power –[1]Internal Drive Power Internal (drive) 12V DC, 250mA		**Encoder Power –External Power Source**	
Encoder Signal –Single-Ended, Dual Channel		**Encoder Signal –Differential, Dual Channel**	

1. SHLD connection is on drive chassis.

2.5.3 Signal and Control Wire Types

Table 2.5 – Recommended Signal Wire

Signal Type/ Where Used	Belden Wire Type(s) *(or equivalent)*		Description	Minimum Insulation Rating
Analog I/O and PTC	8760/9460		0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain[1].	300V, 75-90 degrees C (167-194 degrees F)
	8770		0.750 mm^2 (18 AWG), 3 cond., shielded for remote pot only.	
Encoder/ Pulse I/O <30 m (100 ft.)	Combined:	9730[2]	0.196 mm^2 (24 AWG), individually shielded.	
Encoder/ Pulse I/O 30 to 152 m (100 to 500 ft.)	Signal:	9730/9728[2]	0.196 mm^2 (24 AWG), individually shielded.	
	Power:	8790[3]	0.750 mm^2 (18 AWG)	
	Combined:	9892[4]	0.330 mm^2 or 0.500 mm^2 [4]	
Encoder/ Pulse I/O 152 to 259 m (500 to 850 ft.)	Signal:	9730/9728[2]	0.196 mm^2 (24 AWG), individually shielded.	
	Power:	8790[3]	0.750 mm^2 (18 AWG)	
	Combined:	9773/9774[5]	0.750 mm^2 (18 AWG) or 0.500 mm^2, individually shielded pair	

1. If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.
2. 9730 is 3 individually shielded pairs (2 channel + power). If 3 channel is required, use 9728.
3. 8790 is 1 shielded pair.
4. 9892 is 3 individually shielded pairs (3 channel), 0.33[2] (22 AWG) + 1 shielded pair 0.5 mm^2 (20 AWG) for power.
5. 9773 is 3 individually shielded pairs (2 channel + power). If channel 3 is required, use 9774.

Table 2.6 – Recommended Control Wire for Digital I/O

Type	Wire Type(s)	Description	Minimum Insulation Rating
Unshielded	Per US NEC or applicable national or local code	–	300V, 60 degrees C (140 degrees F)
Shielded	Multi-conductor shielded cable such as Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	

2.5.4 The I/O Control Board

Figure 2.2 shows the I/O control board and terminal block locations. The control board provides a mounting point for the various Reach Drive I/O options. To remove the cassette, loosen the two screw latches as shown in Figure 2.7. (A).

ATTENTION: You must stay within the minimum and maximum wire size range. Failure to observe this precaution can result in severe equipment damage, bodily injury, or loss of life.

2.5.5 I/O Terminal Blocks

Table 2.7 – I/O Terminal Block Specifications

No.	Name	Description	Wire Size Range [4]		Torque	
			Maximum	Minimum	Maximum	Recommended
1	I/O Terminal Block	Signal & control connections	2.1 mm^2 (14 AWG)	0.30 mm^2 (22 AWG)	0.6 N-m (5.2 lb.-in.)	0.6 N-m (5.2 lb.-in.)
2	Encoder Terminal Block	Encoder power & signal connections	0.75 mm^2 (18 AWG)	0.196 mm^2 (24 AWG)	0.6 N-m (5.2 lb.-in.)	0.6 N-m (5.2 lb.-in.)

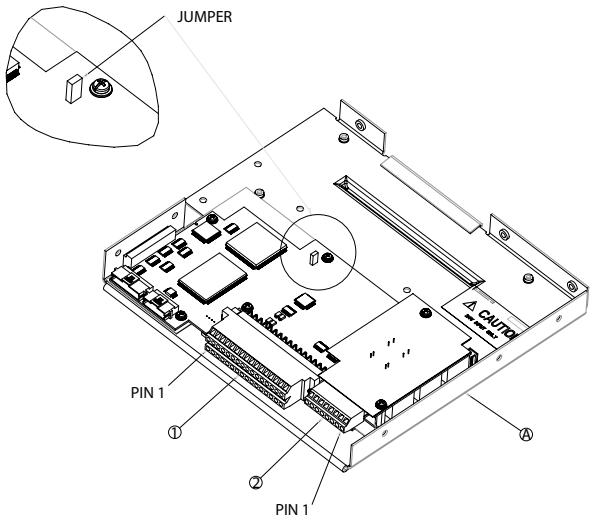


Figure 2.7 – Reach Drive Typical Control Board and I/O Terminal Blocks

4. Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

2.5.6 Hardware Enable Circuitry

By default, the user can program a digital input as an Enable input. The status of this input is *interpreted by drive software*. If the application requires the drive to be disabled *without* software interpretation, a “dedicated” hardware enable configuration can be utilized. This is done by removing a jumper and wiring the enable input to “Digital In 6.” (See tables 2.5 and 2.6 for more information).

1. Remove the I/O Control board.
2. Locate and remove Jumper 10 on the Main Control Board (see Figure 2.7).
3. Re-assemble the I/O Control board.
4. Wire enable to Digital In 6.
5. Verify that Digital In6 Sel (366) is set to “1, Enable.”

2.5.7 Resistance Temperature Detector (RTD) Board

Up to eight RTD or NTC (negative temperature coefficient) temperature sensors are supported by the Reach Drive RTD board. The number of I/O required from an upper level controller to utilize the RTD Board can be managed by selecting one of several configuration options.

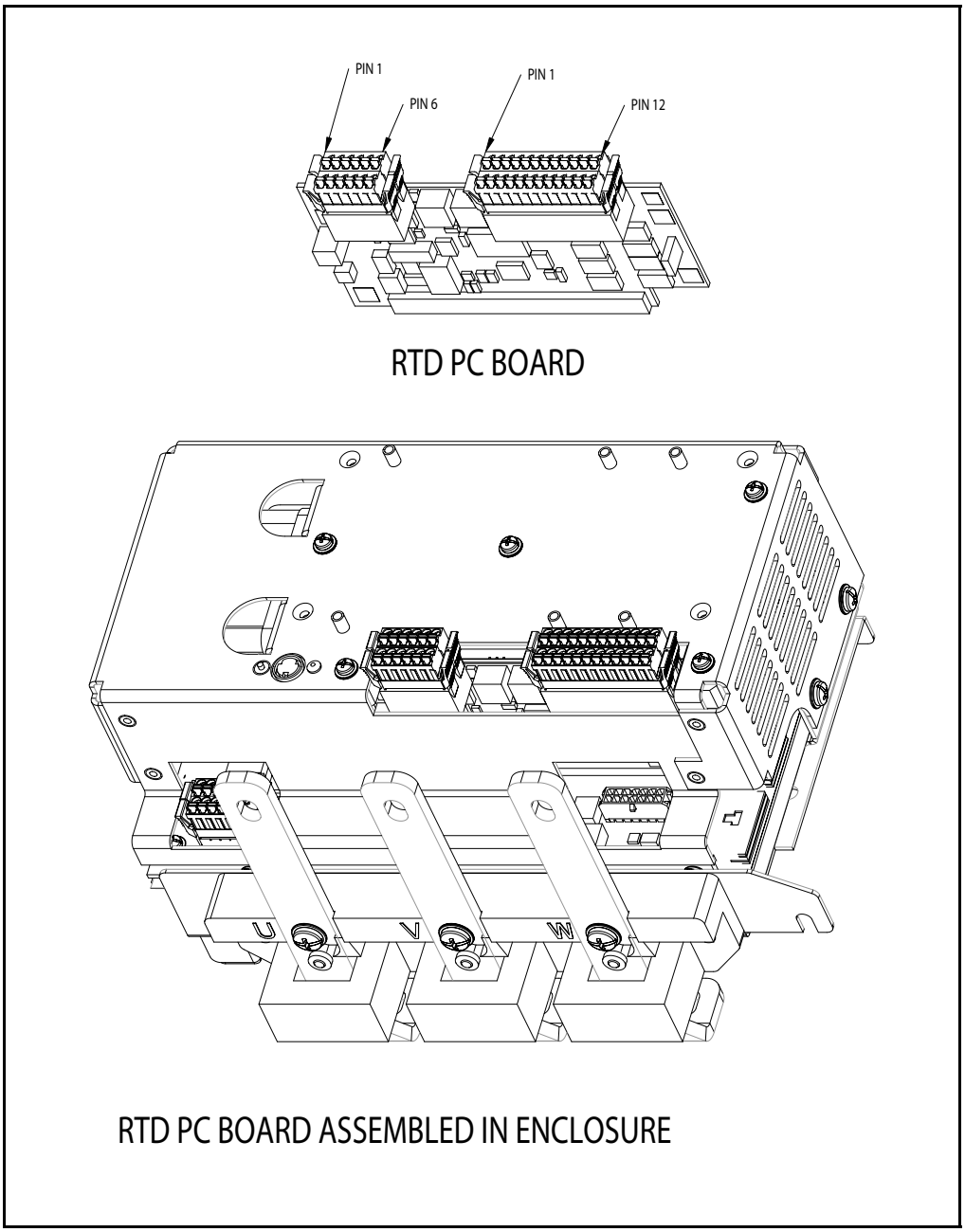


Figure 2.8 – RTD Board

2.5.7.1 Connections

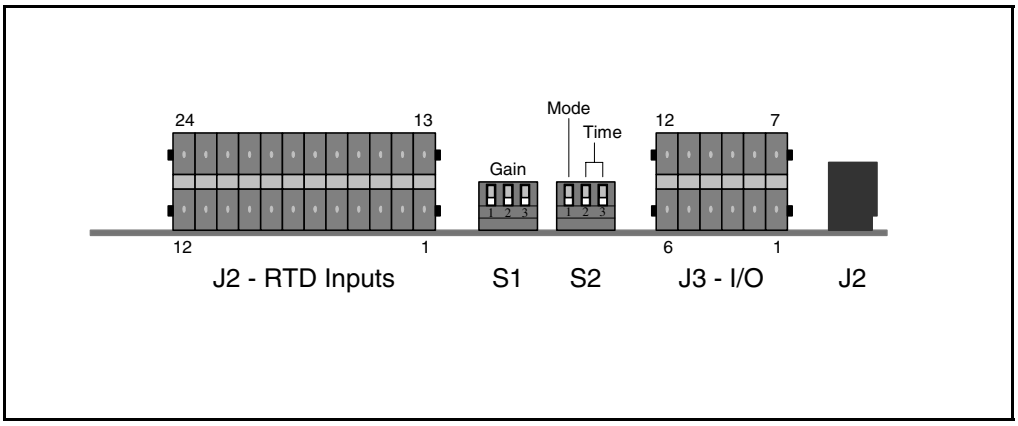


Figure 2.9 – RTD Board Connections

Table 2.8 – J2 RTD Board I/O Function

Position	I/O Function
1	+24V COM
2	LOUT1 COM
3	LOUT2 COM
4	LOUT3 COM
5	LIN COM
6	AOUT COM
7	+24VDC
8	LOUT1 NO
9	LOUT2 NO
10	LOUT3 NO
11	LIN
12	AOUT

Important: A motor temperature sensor (RTD, NTC, or thermocouple) should be considered equivalent to a motor thermostat and wired with the same considerations. Motor thermostat contacts are generally not isolated from the drive/controller digital inputs. Therefore, the sensor inputs will not be isolated on the RTD board.

2.5.7.2 Hardware

The hardware consists of a single PC board with two wired connectors, one for temperature sensors and the second for power and I/O signals.

RTD/NTC Sourcing

A 2-wire RTD or NTC temperature sensor may be used. A chassis connection is available for each sensor for use with shielded cable. Each channel requires up to three connections.

Multiplexer and Amplifier

An analog multiplexer sequentially connects the temperature sensors one at a time to the analog output. The active sensor channel is indicated by a 3-bit output (A0-A2). When using an RTD or NTC, a simple voltage divider is formed and the device is probed differentially.

The sensor voltages are amplified using a high-quality, rail-to-rail instrumentation amplifier with gain adjustment. To accomodate a variety of sensors and temperature ranges, an amplifier boosts the analog sensor voltage in order to increase the temperature resolution. Discrete gains of x10 through x80 are selectable through DIP switch settings. A 4th order low pass filter rejects normal-mode noise at the analog input with a cutoff frequency of approximately 16 Hz.

To determine the proper gain setting:

1. Determine R_{MAX}, the maximum resistance of the sensor over the temperature range to be measured.
2. Determine the maximum voltage across R_{MAX} using the following equation:

$$V_{MAX} = 1.00V \times R_{MAX} / (R_{MAX} + 998)$$

3. Select the largest gain that results in V_{MAX} * Gain (x10, x20, or x40), being less than 10 volts.

Example:

Using a 100 Ohm Pt RTD (a=0.00385) to measure temperatures from 0 degrees Celsius to 200 degrees Celsius, the maximum resistance occurs at 200 degrees Celsius and is approximately 177 Ohm. The maximum voltage across the sensor is 151 mV. If the x40 gain is used, the output voltage at 200 degrees Celsius is 6.04 Volts.

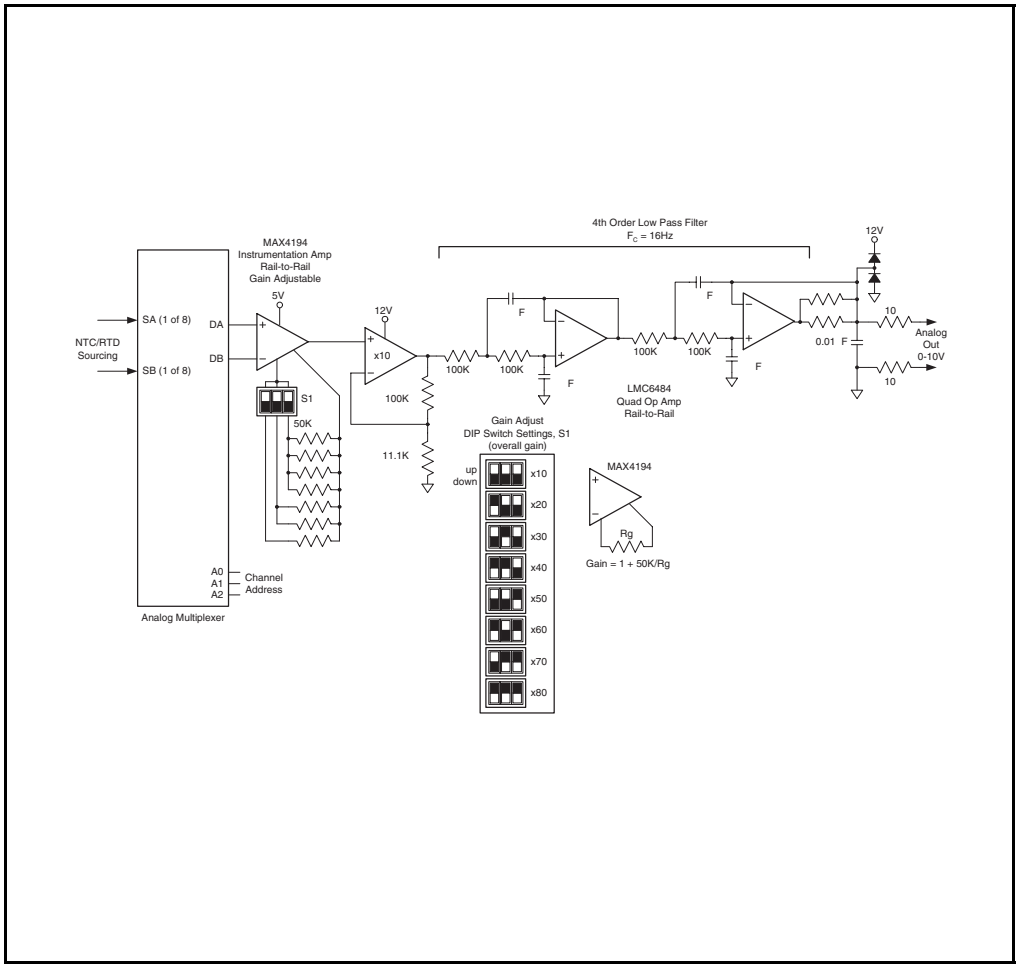


Figure 2.10 – Scaled Analog Output for RTD Board

Digital I/O

The digital outputs are isolated with solid state relays. The outputs are internally short circuit protected. The digital input is optically isolated.

2.5.7.3 Microcontroller Software

A microcontroller monitors three DIP switches to determine the operational mode of the RTD board. A single “Mode” switch determines whether the board uses an internal timebase or the digital input as a clock to step through the eight analog input channels. When using the internal timebase, the other two DIP switches select one of four clock periods.

When the “Mode” switch is up (open) the board uses the digital input as an enable/reset. When the board's digital input is inactive (open or ground), the analog output is held at the first channel. When the digital input is active (24V), the microcontroller sequentially cycles through the eight temperature sensor channels. Each channel is available at the analog output for the selected period of time. After the eighth channel is completed, the cycle begins again with the first channel. Deactivating the digital input will asynchronously reset the sequence back to the first channel. The “Period” jumpers/dip switches select one of four time periods between temperature sensor channels.

Table 2.9 – Microcontroller Settings

Period	S2-2	S2-3
1 second	Down	Down
10 seconds	Up	Down
30 seconds	Down	Up
60 seconds	Up	Up

When the “Mode” switch (S2-1) is down (closed) the board uses the digital input as an external clock to sequentially cycle through the eight temperature sensor channels. The analog output channel advances with both the rising and falling edges of the digital input. In both modes the active channel is output as a 3-bit binary address on the RTD board’s digital outputs. An inactive output (open) indicates a “0.” When using the digital input as an external clock, it may be necessary to monitor the address lines in order to maintain synchronization with the controller. When using the internal clock mode, the digital outputs may be ignored to reduce the required number of I/O. In either mode, the board’s digital input is debounced with a period of 50mS.

CHAPTER 3
Parameter Descriptions

The following information is provided for each parameter along with its description:

Parameter Number:	Unique number assigned to each parameter.
Parameter Name:	Unique name assigned to each parameter.
Range:	Predefined parameter limits or selections. Note that a negative Hz value indicates reverse rotation.
Default:	Factory default setting.
Access:	Parameter access level. 0 = Basic (reduced parameter set) 1 = Standard 2 = Advanced (full parameter set)
Path:	Menu selections to reach specified parameter. The path is indicated in this manner: File>Group
See also:	Associated parameters that may provide additional or related information.

What the Symbols Mean

Symbol	Meaning
	Drive must be stopped before changing parameter value.
FV	Parameter is only displayed when Motor Cntl Sel (53) is set to “4.” (FVC Vector)

The parameters are presented in numerical order.

3.1 Parameters

1 Output Freq

Range: +/-400.0 Hz [0.1 Hz]

Default: Read Only

Access: 0 **Path:** Monitor>Metering

See also:

The output frequency present at T1, T2, and T3 (U, V, and W).

2 Commanded Speed

Range: +/- [P.082 Maximum Speed] [0.1 Hz or 0.1 RPM]

Default: Read Only

Access: 0 **Path:** Monitor>Metering

See also: 79

The value of the active Speed/Frequency Reference. Displayed in Hz or RPM, depending on value of Speed Units (79).

3 Output Current

Range: 0.0 to Drive Rated Amps x 2 [0.1 A]

Default: Read Only

Access: 0 **Path:** Monitor>Metering

See also:

The total output current present at T1, T2, and T3 (U, V, and W).

4 Torque Current

Range: Drive Rating x -2/+2 [0.1 A]

Default: Read Only

Access: 1 **Path:** Monitor>Metering

See also:

The amount of current that is in phase with the fundamental voltage component.

5 Flux Current

Range: Drive Rating x -2/+2 [0.1 A]

Default: Read Only

Access: 1 **Path:** Monitor>Metering

See also:

The amount of current that is out of phase with the fundamental voltage component.

6 Output Voltage

Range: 0.0 to Drive Rated Volts [0.1 VAC]
Default: Read Only
Access: 0 **Path:** Monitor>Metering
See also:

The output voltage present at terminals T1, T2, and T3 (U, V, and W).

7 Output Power

Range: 0 to Drive Rated kW x 2 [0.1 kW]
Default: Read Only
Access: 0 **Path:** Monitor>Metering
See also:

The output power present at T1, T2, and T3 (U, V, and W).

8 Output Powr Fctr

Range: 0.00 to 1.00 [0.01]
Default: Read Only
Access: 2 **Path:** Monitor>Metering
See also:

The output power factor.

9 Elapsed MWh

Range: 0.0 to 214,748,352.0 MWh [0.1 MWh]
Default: Read Only
Access: 2 **Path:** Monitor>Metering
See also:

The accumulated output energy of the drive.

10 Elapsed Run Time

Range: 0.0 to 214,748,352.0 Hr [0.1 Hr]
Default: Read Only
Access: 1 **Path:** Monitor>Metering
See also:

The accumulated time the drive has been outputting power.

11 MOP Reference

Range: +/- [Maximum Speed] [0.1 Hz or 0.1 RPM]

Default: Read Only

Access: 1 **Path:** Monitor>Metering

See also: 79

The value of the signal at the MOP (Motor-Operated Potentiometer).

12 DC Bus Voltage

Range: 0 to Based on Drive Rating [0.1 VDC]

Default: Read Only

Access: 1 **Path:** Monitor>Metering

See also:

The present DC bus voltage level.

13 DC Bus Memory

Range: 0 to Based on Drive Rating [0.1 VDC]

Default: Read Only

Access: 2 **Path:** Monitor>Metering

See also:

A six-minute average of the DC bus voltage level.

14 Elapsed kWh

Range: 0 to 429,496,729.5 kWh [0.1 kWh]

Default: Read Only

Access: 1 **Path:** Monitor>Metering

See also:

The accumulated output energy of the drive.

16 Analog In1 Value
17 Analog In2 Value

Range: 0.000 to 20.000 mA [0.001 mA]
-/+10.000 V [0.001 V]

Default: Read Only

Access: 1 **Path:** Monitor>Metering

See also:

The value of the signal of the analog input.

18 PTC HW Value

Range: 0.00 to 5.00 Volts [0.01 Volts]

Default: Read Only

Access: 2 **Path:** Monitor>Metering

See also:

This parameter displays the value present at the drive's PTC input terminals. When a motor is provided with a PTC (positive temperature coefficient) thermal sensor, it can be connected to terminals 10 and 23.

21 Spd Fdbk No Filt

Range:

Default: Read Only

Access: 2 **Path:** Monitor>Metering

See also:

Displays the unfiltered value of the actual motor speed based on either the measured encoder feedback or on an estimation when an encoder is not present.

22 Ramped Speed

Range: +/- 400.0 Hz or +/- 24,000.0 RPM [0.1 Hz or 0.1 RPM]

Default: Read Only

Access: 1 **Path:** Monitor>Metering

See also: 79

The value of commanded speed after Accel/Decel and S-Curve are applied.

23 Speed Reference

Range: +/- 400.0 Hz or +/- 24,000.0 RPM [0.1 Hz or 0.1 RPM]

Default: Read Only

Access: 0 **Path:** Monitor>Metering

See also: 79

The summed value of ramped speed, process PI and droop. When FVC Vector mode is selected, droop will not be added

24 Commanded Torque

FV

Range: +/- 800.0% [0.1%]
Default: Read Only
Access: 0 **Path:** Monitor>Metering
See also: 53

The final torque reference value after limits and filtering are applied. Percent of motor rated torque.

25 Speed Feedback

Range: +/- 400.0 Hz or +/- 24,000.0 RPM [0.1 Hz or 0.1 RPM]
Default: Read Only
Access: 1 **Path:** Monitor>Metering
See also:

Displays the lightly filtered value of the actual motor speed based on measured encoder feedback or an estimation.

26 Rated kW

Range: 0.00 to 3000.00 kW [0.01 kW]
Default: Read Only
Access: 0 **Path:** Monitor>Drive Data
See also:

The drive power rating.

27 Rated Volts

Range: 0.0 to 65535.0 VAC [0.1 VAC]
Default: Read Only
Access: 0 **Path:** Monitor>Drive Data
See also:

The drive input voltage class (208, 240, 400, etc.).

28 Rated Amps

Range: 0.0 to 6553.5 Amps [0.1 Amps]
Default: Read Only
Access: 0 **Path:** Monitor>Drive Data
See also:

The drive rated output current.

29 Control SW Ver

Range:	0.000 to 65535.000 [0.001]
Default:	Read Only
Access:	0 **Path:** Monitor>Drive Data
See also:	196

The Main Control board software version.

40 Motor Type

Range:	0 = Induction 1 = Synchr Reluc 2 = Synchr PM
Default:	0 = Induction
Access:	2 **Path:** Motor Control>Motor Data
See also:	53, 157, 158, 159

Set to match the type of motor connected: Induction, Synchronous Reluctance, or Synchronous Permanent Magnet.

Important: Selecting option 1 or 2 also requires selection of “Custom V/Hz,” option 2 in Motor Cntl Sel (53).

41 Motor NP Volts

Range:	0.0 to Drive Rated Volts [0.1 VAC]
Default:	Based on Drive Rating
Access:	1 **Path:** Motor Control>Motor Data
See also:	

Set to the motor nameplate rated volts. The motor nameplate base voltage defines the output voltage when operating at rated current, rated speed, and rated temperature.

42 Motor NP FLA

Range:	0.0 to Rated Amps x 2 [0.1 Amps]
Default:	Based on Drive Rating
Access:	1 **Path:** Motor Control>Motor Data
See also:	47, 48

Set to the motor nameplate rated full load amps. The motor nameplate FLA defines the output amps when operating at rated voltage, rated speed, and rated temperature. It is used in the motor thermal overload and in the calculation of slip.

43 Motor NP Hertz

Range: 5.0 to 400.0 Hz [0.1 Hz]
Default: Based on Drive Type
Access: 1 **Path:** Motor Control>Motor Data
See also:

Set to the motor nameplate rated frequency. The motor nameplate base frequency defines the output frequency when operating at rated voltage, rated current, rated speed, and rated temperature.

44 Motor NP RPM

Range: 60.0 to 25200.0 RPM [0.1 RPM]
Default: 1780 RPM
Access: 1 **Path:** Motor Control>Motor Data
See also:

Set to the motor nameplate rated RPM. The motor nameplate RPM defines the rated speed when operating at motor nameplate base frequency, rated current, base voltage, and rated temperature. This is used to calculate slip.

45 Motor NP Power

Range: 0.00 to 1000.00 [0.01 kW or 0.01 HP]
Default: Based on Drive Type
Access: 1 **Path:** Motor Control>Motor Data
See also: 46

Set to the motor nameplate rated power. The motor nameplate power is used with the other nameplate values to calculate default values for motor parameters to assist the commissioning process. This may be entered in horsepower or in kilowatts as selected in Mtr NP Pwr Units (46).

46 Mtr NP Pwr Units

Range: 0 = Horsepower (changes power units to HP without rescaling values)
1 = kilowatts (changes power units to kW without rescaling values)
2 = Convert HP (Converts all power units to HP and rescales values)
3 = Convert kW (changes power units to kW and rescales values)
Default: Based on Drive Rating
Access: 2 **Path:** Motor Control>Motor Data
See also:

Selects the motor power units to be used. This parameter determines the units for Motor NP Power (45).

Convert HP = Converts all power units to Horsepower.

Convert kW = Converts all power units to kilowatts.

47 Motor OL Hertz

Range: 0.0 to Motor NP Hz [0.1 Hz]
Default: Motor NP Hz/3
Access: 2 **Path:** Motor Control>Motor Data
See also: 42, 220

Selects the output frequency below which the motor operating current is derated. The motor thermal overload will then generate a fault at lower levels of current.

48 Motor OL Factor

Range: 0.20 to 2.00 [0.1]
Default: 1.00
Access: 2 **Path:** Motor Control>Motor Data
See also: 42, 220

Sets the amps threshold for motor overload fault.

Motor FLA x OL Factor = Operating Level

49 Motor Poles

Range: 2 to 40 [1 Pole]
Default: 4
Access: 0 **Path:** Motor Control>Motor Data
See also:

Defines the number of poles in the motor.

53 Motor Cntl Sel

Range: 0 = Sensrls Vect
1 = SV Economize
2 = Custom V/Hz
3 = Fan/Pmp-V/Hz
4 = FVC Vector
Default: 0 = Sensrls Vect
Access: 2 **Path:** Motor Control>Torq Attributes
See also: 80

Sets the method of motor control used in the drive.

Important: "FVC Vector" mode with encoder feedback requires autotuning of the motor, both coupled and uncoupled to the load. Being coupled to the load will determine inertia (preferably lightly loaded). Total Inertia (450) will have to be estimated if uncoupled for tuning of the speed loop or separately adjust Ki (445) and Kp (446).

Sensrls Vect = Maintains consistent magnetizing current up to base speed. Voltage increases as a function of load.

SV Economize = Allows the drive to automatically adjust output voltage as the load changes to minimize current supplied to the motor. The voltage is adjusted by means of flux current adaptation.

Custom V/Hz = Allows the user to tailor the volts/hertz curve by adjusting parameters Maximum Voltage (54), Maximum Frequency (55), Run Boost (70), Break Voltage (71) and Break Frequency (72).

Fan/Pmp V/Hz = This mode sets a fan load volts/hertz curve profile exponential to base frequency (and linear from base to maximum frequency). Run Boost (70) can offset the low speed curve point.

FVC Vector = This mode requires autotuning of the motor, both coupled and uncoupled to the load.

54 Maximum Voltage

Range: (Rated Volts x 0.25) to Rated Volts [0.1 VAC]

Default: Drive Rated Volts

Access: 2 **Path:** Motor Control>Torq Attributes

See also:

Sets the highest voltage the drive will output.

55 Maximum Freq

Range: 5.0 to 420.0 Hz [0.1 Hz]

Default: 110.0 or 130.0 Hz

Access: 2 **Path:** Motor Control>Torq Attributes

See also: 83

Sets the maximum allowable frequency the drive will output. Note that this is not maximum speed, which is set in parameter 82. Refer to figure 3.1.

ATTENTION: The user is responsible for ensuring that the driven machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. The factory default for overspeed detection is set to 10.0 Hz (or 300.0 RPM) greater than the Maximum Speed (82). Failure to observe this precaution could result in equipment damage, sever injury or loss of life.

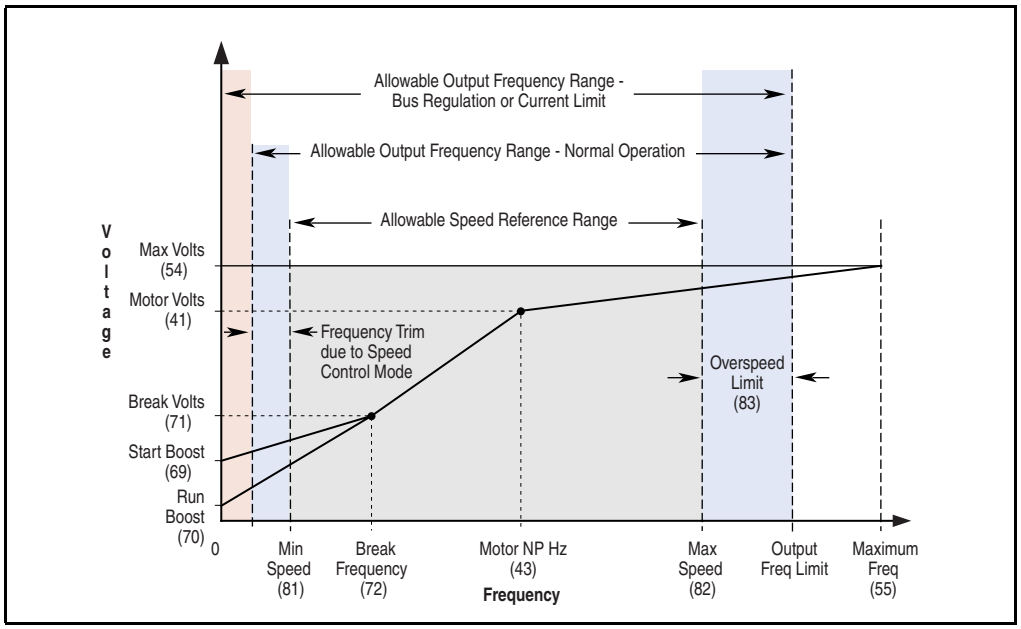


Figure 3.1 – Speed Limits

56 Compensation

Range: See figure 3.2

Default: See figure 3.2

Access: 2 **Path:** Motor Control>Torq Attributes

See also:

Enables/disables the compensation correction options.

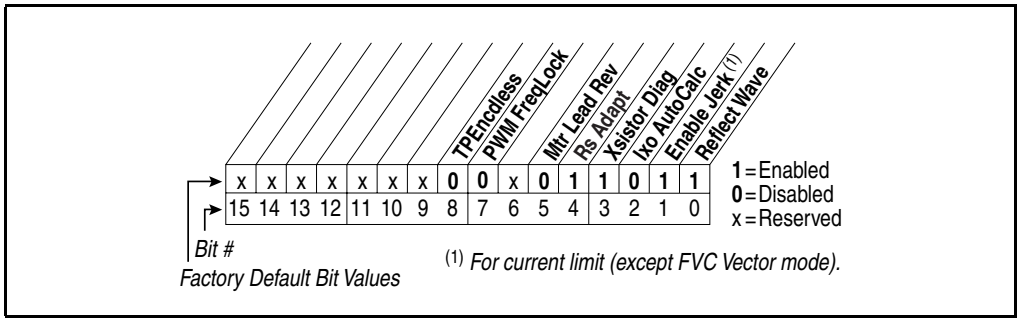

TPEncdless
PWM FreqLock
Mtr Lead Rev
Rs Adapt
Xsistor Diag
Ixo AutoCalc
Enable Jerk (1)
Reflect Wave
x x x x x x x 0 0 x 0 1 1 0 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
1 = Enabled
0 = Disabled
x = Reserved
Bit #
Factory Default Bit Values
(1) For current limit (except FVC Vector mode).

Figure 3.2 – Compensation (56)

Reflect Wave = Enables/disables reflected wave correction software, which reduces overvoltage transients from the drive to the motor. For lead lengths beyond 300 feet, enable this feature**.**

Enable Jerk = Enables/disables the jerk limit in the current limiter that helps to eliminate overcurrent trips on fast accelerations. Disable this feature if your application requires the actual acceleration of the motor to be faster than .25 sec. In non-FVC Vector modes, disabling jerk removes a short S-curve at the start of the accel/decel ramp.

Ixo AutoCalc = Reserved

Xsistor Diag = Enables/disables power transistor power diagnostic tests that execute at each Start command.

Rs Adapt = (FVC w/Encoder only) Disabling may improve torque regulation at lower speeds (although this is typically not needed).

Mtr Lead Rev = Reverses the phase rotation of the applied voltage, effectively reversing the motor leads.

PWM Freq Lock = Keeps the PWM frequency from decreasing to 2 kHz at low operating frequencies in FVC Vector mode without encoder.

57 Flux Up Mode

Range:	0 = Manual 1 = Automatic
Default:	0 = Manual
Access:	2 **Path:** Motor Control>Torq Attributes
See also:	53, 58

Manual (0): Flux is established for Flux Up Time (58) before acceleration

Auto (1): Flux is established for a calculated time period based on motor nameplate data. Flux Up Time (58) is not used.

58 Flux Up Time

Range:	0.000 to 5.000 sec [0.001 sec]
Default:	0.000 sec
Access:	2 **Path:** Motor Control>Torq Attributes
See also:	53, 58

Sets the amount of time the drive will use to try to achieve full motor stator flux. When a start command is issued, DC current at current limit level is used to build stator flux before accelerating.

59 SV Boost Filter

Range:	0 to 32767 [1]
Default:	500
Access:	0 **Path:** Motor Control>Torq Attributes
See also:	

Sets the amount of filtering used to boost voltage during Sensorless Vector and FVC Vector (encoderless) operation.

61 Autotune

Range:	0 = Ready 1 = Static Tune 2 = Rotate Tune 3 = Calculate
Default:	3 = Calculate
Access:	1 **Path:** Motor Control>Torq Attributes
See also:	53, 62

Provides a manual or automatic method for setting IR Voltage Drop (62), Flux Current Ref (63) and Ixo Voltage Drop (64). Valid only when Motor Cntl Sel (53) is set to Sensrls Vect, SV Economize or FVC Vector.

Ready (0) = Parameter returns to this setting following a Static Tune or Rotate Tune. It also permits manually setting IR Voltage Drop (62), Ixo Voltage Drop (64) and Flux Current Ref (63).

Static Tune (1) = A temporary command that initiates a non-rotational motor stator resistance test for the best possible automatic setting of IR Voltage Drop (62) in all valid modes and a non-rotational motor leakage inductance test for the best possible automatic setting of Ixo Voltage Drop (64) in FVC Vector Mode. A start command is required following the initiation of this setting. The parameter returns to Ready (0) following the test, at which time another start transition is required to operate the drive in normal mode. Used when the motor cannot be rotated.

Rotate Tune (2) = A temporary command that initiates a Static Tune followed by a rotational test for the best possible automatic setting of Flux Current Ref (63). In FVC Vector mode, with encoder feedback, a test for the best possible automatic setting of Slip RPM @ FLA is also run. A start command is required following initiation of this setting. The parameter returns to Ready (0) following the test, at which time another start transition is required to operate the drive in normal mode.

Important: Rotate Tune (2) is used when the motor is uncoupled from the load. Results may not be valid if a load is coupled to the motor during this procedure.

ATTENTION: Rotation of the motor in an undesired direction can occur during this procedure (Autotune (61) = Rotate Tune (2)). To guard against possible injury and/or equipment damage, it is recommended that the motor be disconnected from the load before proceeding.

Calculate (3) = This setting uses motor nameplate data to automatically set IR Voltage Drop (62), Ixo Voltage (64) and Flux Current Ref (63).

62 IR Voltage Drop

Range: 0.0 to Motor NP Volts x 0.25 [0.1 VAC]

Default: Based on Drive Rating

Access: 1 **Path:** Motor Control>Torq Attributes

See also: 53, 61

Value of volts dropped across the resistance of the motor stator. Used only when Motor Cntl Sel (53) is set to Sensrls Vect, SV Economize or FVC Vector.

63 Flux Current Ref

Range: 0.00 to Motor NP FLA [0.01 Amps]

Default: Based on Drive Rating

Access: 1 **Path:** Motor Control>Torq Attributes

See also: 53, 61

Value of amps for full motor flux. Used only when Motor Cntl Sel (53) is set to Sensrls Vect, SV Economize or FVC Vector.

64 Ixo Voltage Drop

Range: 0.00 to 230.0, 460.0 or 575.0 VAC [0.1 VAC]

Default: Based on Drive Rating

Access: 1 **Path:** Motor Control>Torq Attributes

See also:

Sets the value of the voltage drop across the leakage inductance of the motor at rated motor current. Used only when Motor Cntl Sel (53) is set to Sensrls Vect, SV Economize or FVC Vector.

66 Autotune Torque

FV

Range: 0.0 to 150% [0.1%]

Default: 50%

Access: 1 **Path:** Motor Control>Torq Attributes

See also: 53

Specifies motor torque applied to the motor during the flux current and inertia tests performed during an autotune.

67 Inertia Autotune

Range: 0 = Ready
1 = Inertia Tune

Default: 0 = Ready

Access: 1 **Path:** Motor Control>Torq Attributes

See also: 53, 450

Provides an automatic method of setting Total Inertia. This test is automatically run during Start-Up motor tests.

Important: Use when motor is coupled to the load. Results may not be valid if the load is not coupled to the motor during this procedure.

Ready = Parameter returns to this setting following a completed inertia tune.

Inertia Tune = A temporary command that initiates an inertia test of the motor/load combination. The motor will ramp up and down, while the drive measures the amount of inertia.

69 Start/Acc Boost

Range: 0.0 to Motor NP Volts x 0.25 [0.1 VAC]

Default: Based on drive rating

Access: 2 **Path:** Motor Control>Volts per Hertz

See also: 53, 70

Sets the voltage boost level for starting and acceleration when Custom V/Hz mode is selected.

70 Run Boost

Range: 0.0 to Motor NP Volts x 0.25 [0.1 VAC]

Default: Based on drive rating

Access: 2 **Path:** Motor Control>Volts per Hertz

See also: 53, 69,

Sets the boost level for steady state or deceleration when Fan/Pmp V/Hz or Custom V/Hz modes are selected.

71 Break Voltage

Range: 0.0 to Motor NP Volts [0.1 VAC]

Default: Motor NP Volts x 0.25

Access: 2 **Path:** Motor Control>Volts per Hertz

See also: 53, 72

Sets the voltage the drive will output at Break Frequency (72).

72 Break Frequency

Range: 0.0 to Maximum Freq [0.1 Hz]

Default: Motor NP Freq x 0.25

Access: 2 **Path:** Motor Control>Volts per Hertz

See also: 53, 71

Sets the frequency the drive will output at Break Voltage (71).

79 Speed Units

Range: 0 = Hz
1 = RPM
2 = Convert Hz
3 = Convert RPM

Default: 0 = Hz

Access: 0 **Path:** Speed Command>Spd Mode & Limits

See also:

Selects the units to be used for all speed related parameters. Options 0 and 1 indicate status only. Options 2 and 3 will convert and/or configure the drive for that selection.

Convert Hz (2) = Converts all speed based parameters to Hz and changes the value proportionately (i.e. 1800 RPM = 60 Hz).

Convert RPM (3) = Converts all speed based parameters to RPM and changes the value proportionately.

80 Feedback Select

Range: 0 = Open Loop
1 = Slip Comp
2 = Reserved
3 = Encoder
4 = Reserved
5 = Simulator

Default: 0 = Open Loop

Access: 2 **Path:** Speed Command>Spd Mode & Limits

See also: 53, 152, 412

Selects the source for motor speed feedback. Note that all selections are available when using Process PI.

ATTENTION: When operating the drive with encoder feedback selected (Feedback Select (80) = 3 (Encoder)), a loss of encoder signal may produce an overspeed condition. For differential encoders, Motor Fdbk Type (412) should be selected as option 1 or 3 to detect the loss of an encoder signal. The user is responsible for ensuring that the driven machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. The factory default for overspeed detection is set to 10.0 Hz (or 300.0 RPM) greater than the Maximum Speed (82). Failure to observe this precaution could result in equipment damage, sever injury or loss of life.

Open Loop (0) = Provides no speed compensation due to load variations. This is strict volts per hertz output as a function of the speed reference. Slip compensation is not needed and encoder is not present.

Slip Comp (1) = Provides for frequency output adjustment as a function of load. The amount of compensation is defined by the value of Slip RPM @ FLA (121). It is used when tight speed control is needed and an encoder is not present.

Encoder (3) = An encoder is present and connected to the drive.

Simulator (5) = Simulates a motor for testing drive operation and interface check.

81 Minimum Speed

Range:	0.0 to Maximum Speed [0.1 Hz or 0.1 RPM]
Default:	0.0
Access:	0 **Path:** Speed Command>Spd Mode & Limits
See also:	79, 83, 92, 95

Sets the low limit for the speed reference after scaling is applied.

ATTENTION: The drive can operate at and maintain zero speed. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or may operate at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

82 Maximum Speed

Range:	5.0 to 400.0 [0.1 Hz] or 75.0 to 24000.0 RPM [0.1 RPM]
Default:	50.0 or 60.0 Hz (Volt Class) [Motor NP RPM]
Access:	0 **Path:** Speed Command>Spd Mode & Limits
See also:	55, 79, 83, 91, 94, 202

Sets the high limit for the speed reference after scaling is applied.

ATTENTION: The user is responsible for ensuring that the driven machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. The factory default for overspeed detection is set to 10.0 Hz (or 300.0 RPM) greater than the Maximum Speed (82). Failure to observe this precaution could result in equipment damage, sever injury or loss of life.

83 Overspeed Limit

Range: 0.0 to 20.0 Hz [0.1 Hz] or 0.0 to 600.0 RPM [0.1 RPM]

Default: 10.0 Hz or 300.0 RPM

Access: 2 **Path:** Speed Command>Spd Mode & Limits

See also: 55, 79, 82

Sets the incremental amount of the output frequency (above Maximum Speed) allowable for functions such as slip compensation. See figure 3.3.

Maximum Speed + Overspeed Limit must be ≤to Maximum Frequency

ATTENTION: The user is responsible for ensuring that the driven machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. The factory default for overspeed detection is set to 10.0 Hz (or 300.0 RPM) greater than the Maximum Speed (82). Failure to observe this precaution could result in equipment damage, sever injury or loss of life.

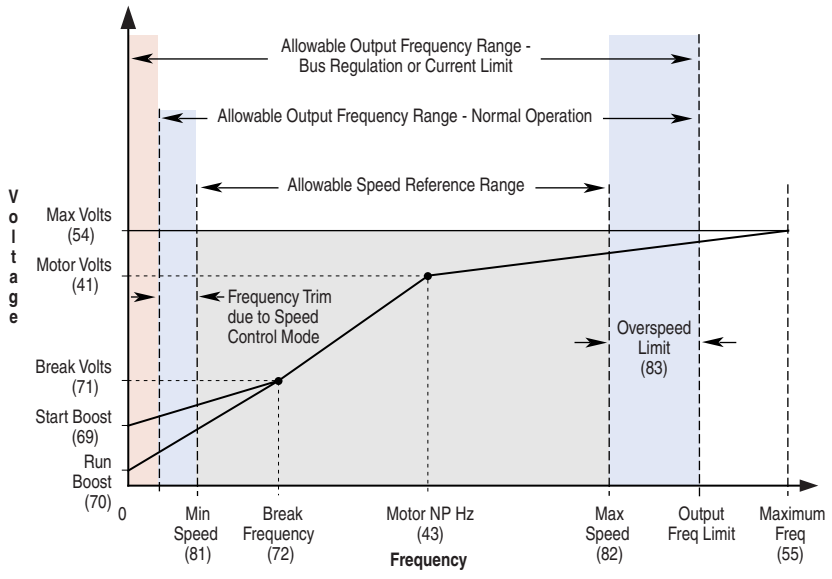


Figure 3.3 – Speed Limits

84 Skip Frequency 1
85 Skip Frequency 2
86 Skip Frequency 3

Range: -/+ Maximum Speed [0.1 Hz]

Default: 0.0 Hz

Access: 2 **Path:** Speed Command>Spd Mode & Limits

See also: 87

Sets a frequency at which the drive will not operate (also called an **avoidance frequency**). Requires that both Skip Frequency 1-3 and Skip Frequency Band (87) be set to a value other than 0.

87 Skip Freq Band

Range: 0.0 to 30.0 Hz [0.1 Hz]

Default: 0.0 Hz

Access: 2 **Path:** Speed Command>Spd Mode & Limits

See also: 84, 85, 86

Determines the bandwidth around a skip frequency (half the band above and half the band below the skip frequency). The same bandwidth applies to all skip frequencies.

88 Speed/Torque Mod

FV

Range:
0 = Zero Torque
1 = Speed Reg
2 = Torque Reg
3 = Min Torq/Spd
4 = Max Torq/Spd
5 = Sum Torq/Spd
6 = Absolute Min
7 = Pos/Spd Prof

Default: 1 = Speed Reg

Access: 1 **Path:** Speed Command>Spd Mode & Limits

See also: 53

ATTENTION: When selecting operation in a torque mode configuration, the user is responsible for ensuring that the driven machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. The factory default for overspeed detection is set to 10.0 Hz (or 300.0 RPM) greater than the Maximum Speed (82). Failure to observe this precaution could result in equipment damage, sever injury or loss of life.

Selects the torque reference source.

Zero Torque (0) = Torque Command = 0.

Speed Reg (1) = Drive operates as a speed regulator.

Torque Reg (2) = An external torque reference is used for the torque command.

Min Torq/Spd (3) = Selects the smallest algebraic value to regulate to when the torque reference and torque generated from the speed regulator are compared.

Max Torq/Spd (4) = Selects the largest algebraic value to regulate to when the torque reference and torque generated from the speed regulator are compared.

Sum Torq /Spd (5) = Selects the sum of the torque reference and the torque generated from the speed regulator.

Absolute Min (6) = Selects the smallest absolute algebraic value to regulate to when the torque reference and torque generated from the speed regulator are compared.

Pos/Spd Prof (7) = Drive operates as a speed or position regulator as determined by the steps configured by the Profile Step parameters (720-877) and Setup parameters (705-719).

89 Logic Source Sel

Range:	0 = Terminal Blk 1 = Local HIM 2 = DPI Port 2 3 = DPI Port 3 4 = Reserved 5 = Network 6 = Reserved 7 = All Ports		
Default:	1 = Local HIM		
Access:	0	**Path:**	Speed Command>Control Src Sel
See also:			

Selects the only control source for these logic commands:

- Start (Run)
- Jog
- Direction
- Clear Faults
- Stop (Any attached HIM Stop Key is always functional. A Network stop command is effective only for Network or All Ports. A Terminal Block Stop command is effective only for Terminal Blk or All Ports.

Selecting All Ports (7) enables control from any control source (or port).

ATTENTION: Changing parameter 89 to Terminal Blk or Network while Start At PowerUp is enabled may start the drive if a start command is on from the newly selected logic source.

When Start At PowerUp is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Removing and replacing the LCD HIM while the drive is running may cause an abrupt speed change if the LCD HIM is the selected reference source, but is not the selected control source. The drive will ramp to the reference level provided by the HIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142) and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

Important: Asserting an HIM Control digital input or acquiring Manual with Save HIM Ref (192) bit 1 (Manual Mode) True (1) will override this parameter's selection.

90 Speed Ref A Sel

Range:
1 = Analog In 1
2 = Analog In 2
3-6 = Reserved
7 = Pulse In
8 = Encoder
9 = MOP Level
10 = Reserved
11 = Preset Spd 1
12 = Preset Spd 2
13 = Preset Spd 3
14 = Preset Spd 4
15 = Preset Spd 5
16 = Preset Spd 6
17 = Preset Spd 7
18 = Local HIM
19 = DPI Port 2
20 = DPI Port 3
21 = DPI Port 4
22 = Network
23-24 = Reserved
25 = Scale Block 1
26 = Scale Block 2
27 = Scale Block 3
28 = Scale Block 4

Default: 18 = Local HIM

Access: 0 **Path:** Speed Command>Speed References
Speed Command>Control Src Select

See also: 2, 91-93, 101-107, 117-120, 192-194, 213, 272, 273, 320, 361-366

Selects the source of the speed reference to the drive unless Preset Speed 1-7 (101-107) or Speed Ref B (93) is selected.

Note that the manual reference command and input HIM Control can override the reference control source.

ATTENTION: Removing and replacing the LCD HIM while the drive is running may cause an abrupt speed change if the LCD HIM is the selected reference source. The drive will ramp to the reference level provided by the HIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142) and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

91 Speed Ref A Hi

Range: -/+Maximum Speed [0.1 Hz or 0.1 RPM]

Default: Maximum Speed

Access: 1 **Path:** Speed Command>Speed References

See also: 79, 82, 190

Scales the upper value of the Speed Ref A Sel (90) selection when the source is an analog input.

92 Speed Ref A Lo

Range: -/+Maximum Speed [0.1 Hz or 0.01 RPM]

Default: 0.0

Access: 1 **Path:** Speed Command>Speed References

See also: 79, 81, 190

Scales the lower value of the Speed Ref A Sel (90) selection when the source is an analog input.

93 Speed Ref B Sel

Range:	1 = Analog In 1 2 = Analog In 2 3-6 = Reserved 7 = Pulse In 8 = Encoder 9 = MOP Level 10 = Reserved 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Preset Spd 7 18 = Local HIM 19 = DPI Port 2 20 = DPI Port 3 21 = DPI Port 4 22 = Network 23-24 = Reserved 25 = Scale Block 1 26 = Scale Block 2 27 = Scale Block 3 28 = Scale Block 4
Default:	11 = Preset Spd 1
Access:	0 **Path:** Speed Command>Speed References Speed Command> Control Src Select
See also:	2, 91-93, 101-107, 117-120, 192-194, 213, 272, 273, 361-366

Selects the source of the speed reference to the drive unless Preset Speed 1-7 (101-107) is selected.

Note that the manual reference command and input HIM Control can override the reference control source.

ATTENTION: Removing and replacing the LCD HIM while the drive is running may cause an abrupt speed change if the LCD HIM is the selected reference source. The drive will ramp to the reference level provided by the HIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142) and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

94 Speed Ref B Hi

Range: -/+Maximum Speed [0.1 Hz or 0.01 RPM]

Default: Maximum Speed

Access: 1 **Path:** Speed Command>Speed References

See also: 79, 93, 190

Scales the upper value of the Speed Ref B Sel (93) selection when the source is an analog input.

95 Speed Ref B Lo

Range: -/+Maximum Speed [0.1 Hz or 0.01 RPM]

Default: 0.0

Access: 1 **Path:** Speed Command>Speed References

See also: 79, 90, 93, 190

Scales the lower value of the Speed Ref B Sel (93) selection when the source is an analog input.

96 TB Man Ref Sel

Range: 1 = Analog In 1
2 = Analog In 2
3-8 = Reserved
9 = MOP Level

Default: 2 = Analog In 2

Access: 1 **Path:** Speed Command>Speed References

See also: 97, 98

Specifies the manual speed reference source when a digital input is configured for auto/manual.

Important: Analog In 2 is not a valid selection if it was selected for Trim In Select (117), PI Feedback Sel (128), PI Reference Sel (126), Current Lmt Sel (147) or Sleep Wake Ref (179).

97 TB Man Ref Hi

Range: -/+Maximum Speed [0.1 Hz or 0.01 RPM]

Default: Maximum Speed

Access: 1 **Path:** Speed Command>Speed References

See also: 79, 96

Scales the upper value of the TB Man Ref Sel selection when the source is an analog input.

98 TB Man Ref Lo

Range: -/+Maximum Speed [0.1 Hz or 0.01 RPM]

Default: 0.0

Access: 1 **Path:** Speed Command>Speed References

See also: 79, 96

Scales the lower value of the TB Man Ref Sel selection when the source is an analog input.

99 Pulse Input Ref

Range: -/+ 400.0 Hz or -/+ 24000.0RPM [0.1 Hz or 0.1 RPM]

Default: Read Only

Access: 0 **Path:** Speed Command>Speed References

See also:

Displays the pulse input value as seen at terminals 5 and 6 of the Encoder Terminal Block if Encoder Z Chan (423) is set to “Pulse Input.”

100 Jog Speed 1

Range: +/- Maximum Speed [0.1 Hz or 0.1 RPM]

Default: 10.0 Hz or 300.0 RPM

Access: 0 **Path:** Speed Command>Discrete Speeds

See also: 79

Sets the output frequency/speed when a jog command is issued. Units are selected by Speed Units (79).

101 Preset Speed 1
102 Preset Speed 2
103 Preset Speed 3
104 Preset Speed 4
105 Preset Speed 5
106 Preset Speed 6
107 Preset Speed 7

Range: -/+Maximum Speed [0.1 Hz or 1 RPM]

Default: See table 3.1

Access: See table 3.1 **Path:** Speed Command>Discrete Speeds

See also: 79, 90, 93

Provides an internal fixed speed command value. In bipolar mode, direction is commanded by the sign of the reference.

Table 3.1 – Default Values for Preset Speeds 1-7

Parameter No.	Parameter Name	Default	Access
101	Preset Speed 1	5.0 Hz or 150 RPM	0
102	Preset Speed 2	10.0 Hz or 300 RPM	2
103	Preset Speed 3	20.0 Hz or 600 RPM	2
104	Preset Speed 4	30.0 Hz or 900 RPM	2
105	Preset Speed 5	40.0 Hz or 1200 RPM	2
106	Preset Speed 6	50.0 Hz or 1500 RPM	2
107	Preset Speed 7	60.0 Hz or 1800 RPM	2

108 Jog Speed 2

Range: -/+ Maximum Speed [0.1 Hz or 0.1 RPM]

Default: 10.0 Hz or 300.0 RPM

Access: 0 **Path:** Speed Command>Discrete Speeds

See also:

Sets the output frequency of the drive when Jog Speed 2 is selected.

116 Trim % Setpoint

Range: -/+ 200.0% [0.1 %]

Default: 0.0%

Access: 2 **Path:** Speed Command>Speed Trim

See also: 118

Adds or subtracts a percentage of the speed reference or maximum speed. Dependent on the setting of Trim Out Select (118).

117 Trim In Select

Range: 0 = Setpoint
1 = Analog In 1
2 = Analog In 2
3-6 = Reserved
7 = Pulse In
8 = Encoder
9 = MOP Level
10 = Reserved
11 = Preset Spd 1
12 = Preset Spd 2
13 = Preset Spd 3
14 = Preset Spd 4
15 = Preset Spd 5
16 = Preset Spd 6
17 = Preset Spd 7
18 = Local HIM
19 = DPI Port 2
20 = DPI Port 3
21 = DPI Port 4
22 = Network
23-24 = Reserved
25 = Scale Block 1
26 = Scale Block 2
27 = Scale Block 3
28 = Scale Block 4

Default: 1 = Analog In 1

Access: 2 **Path:** Speed Command>Speed Trim

See also: 90, 93

Specifies which input signal is being used as a trim input. The trim is an input signal that is added to the selected speed reference. If an analog input is used as the trim signal, two scaling parameters [Trim Hi (119) and Trim Lo (120)] are provided.

118 Trim Out Select

Range: See figure 3.4

Default: See figure 3.4

Access: 2 **Path:** Speed Command>Speed Trim

See also: 117, 119, 120

Specifies which speed references are to be trimmed.

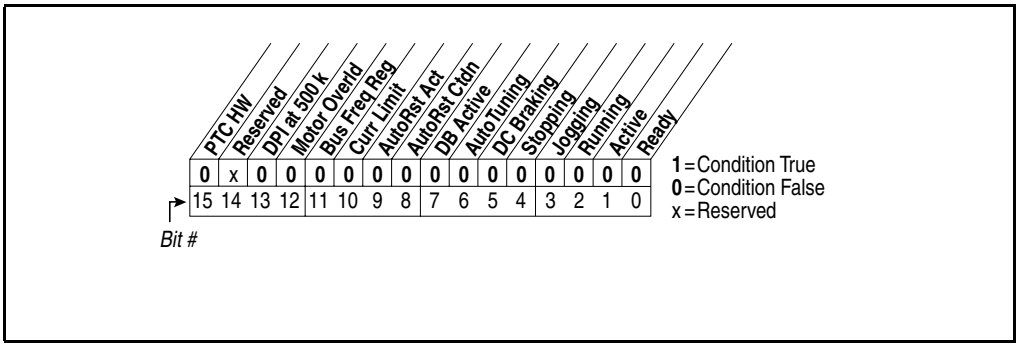


Figure 3.4 – Trim Out Select (118)

119 Trim Hi

Range: -/+Maximum Speed [0.1 Hz or 1 RPM/%]

Default: 60.0 Hz

Access: 2 **Path:** Speed Command>Speed Trim

See also: 79, 82, 117

Scales the upper value of the Trim In Select (117) selection when the source is an analog input.

120 Trim Lo

Range: -/+Maximum Speed [0.1 Hz] or 1 RPM/%]

Default: 0.0 Hz

Access: 2 **Path:** Speed Command>Speed Trim

See also: 79, 117

Scales the lower value of the Trim In Select (117) selection when the source is an analog input.

Important: Parameters 121, 122, and 123 are used to enable and tune the Slip Compensation Regulator. In order to allow the regulator to control drive operation, Feedback Select (80) must be set to 1 = Slip Comp.

121 Slip RPM @ FLA

Range: 0.0 to 1200.0 RPM [0.1 RPM]

Default: Based on Motor NP RPM

Access: 2 **Path:** Speed Command>Slip Comp

See also: 61, 80, 122, 123

Sets the amount of compensation to drive output at motor FLA. If Autotune (61) is set to 3 = Calculate, changes made to this parameter will not be accepted.

Value may be changed by Autotune (61) when “Encoder” is selected in Feedback Select (80).

122 Slip Comp Gain

Range: 1.0 to 100.0 [0.1]

Default: 40.0

Access: 2 **Path:** Speed Command>Slip Comp

See also: 80, 121, 122

Sets the response time of slip compensation.

123 Slip RPM Meter

Range: -/+300.0 RPM [0.1 RPM]

Default: Read Only

Access: 2 **Path:** Speed Command>Slip Comp

See also: 80, 121, 122

Displays the present amount of adjustment being applied as slip compensation.

Important: Parameters in the Process PI Group are used to enable and tune the PI Loop. In order to allow the PI Loop to control drive operation, set PI Control (125) to Enabled, bit 0 = 1.

124 PI Configuration

Range: See figure 3.5

Default: See figure 3.5

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

Selects specific features of the PI regulator.

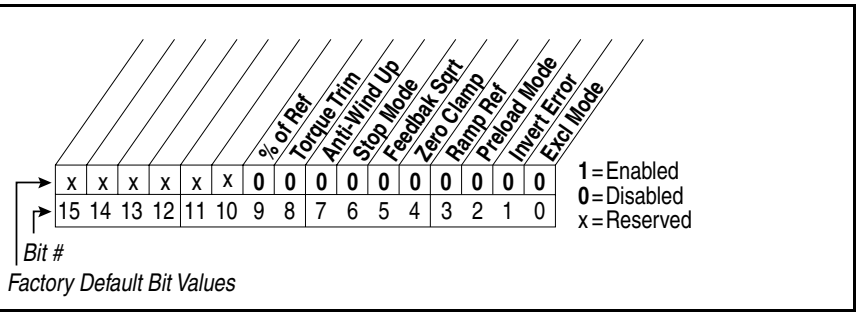

% of Ref
Torque Trim
Anti-Wind Up
Stop Mode
Feedbak Sqrt
Zero Clamp
Ramp Ref
Preload Mode
Invert Error
Excl Mode
x x x x x x 0 0 0 0 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values
1 = Enabled
0 = Disabled
x = Reserved

Figure 3.5 – PI Configuration (124)

Bit 0 - Excl Mode (Exclusive Mode)

- Enabled = Selects speed regulation.
- Disabled = Selects trim regulation.

Bit 1 - Invert Error

- Enables/disables the option to invert the sign of the PI error signal. Enabling this feature creates a decrease in output for an increasing error and an increase in output for a decreasing error.

Bit 2 - Preload Mode

- Enabled = Initializes the PI integrator to the commanded speed while the PI is disabled.
- Disabled = The PI integrator is loaded with the PI Pre-load (133) while the PI is disabled.

Bit 3 - Ramp Ref

- Enables/disables ramping the reference used from PI Feedback to the selected PI Reference after PI is enabled. The active accel time is used for the PI ramp reference slew rate. The ramping is bypassed when the reference equals the setpoint.

Bit 4 - Zero Clamp

- Enables/disables option to limit operation so that the output frequency always has the same sign as the master speed reference. This limits the possible drive action to one direction only. Output from the drive will be from zero to maximum frequency forward or zero to maximum frequency reverse.

Bit 5 - Feedback Sqrt (Square Root Feedback)

- Enables/disables the option of using the square root of the feedback signal as the PI feedback. This is used for pressure control because fans and pumps vary pressure with the square of the speed.

Bit 6 - Stop Mode

- Enabled = A Stop command is issued to the drive and the PI Loop will continue to operate during the decel ramp.

Bit 7 - Anti-Windup

Enabled = The PI Loop will automatically prevent the integrator from creating an excessive error that could cause instability. The integrator will be controlled without the need for PI Reset or PI Hold Inputs.

Bit 8 - Torque Trim

- PI Output summed into the Torque Input.

Bit 9 - % of Ref

- PI scaled to % of Ref instead of Max Frequency.

125 PI Control

Range: See figure 3.6

Default: See figure 3.6

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

Controls the PI regulator. Note that you must use a datalink to write to this parameter interactively from a network.

PI control allows the drive to take a reference signal (setpoint) and an actual signal (feedback) and automatically adjust the speed of the drive to match the actual signal to the reference.

Proportional control (P) adjusts the output based on the size of the error (larger error = proportionally larger correction).

Integral control (I) adjusts the output based on the duration of the error. The integral control by itself is a ramp output correction. This type of control gives a smoothing effect to the output and will continue to integrate until zero error is achieved.

By itself, integral control is slower than many applications require, and, therefore, is combined with proportional control (PI).

The purpose of the PI regulator is to regulate a process variable such as position, pressure, temperature, or flow rate, by controlling speed.

There are two ways the PI regulator can be configured to operate (see parameter 124):

- Process trim, which takes the output of the PI regulator and sums it with a master speed reference to control the process.
- Process control, which takes the output of the PI regulator as the speed command. No master speed reference exists, and the PI output directly controls the drive output.

Note that Feedback Select (80) must be set to Process PI (2).

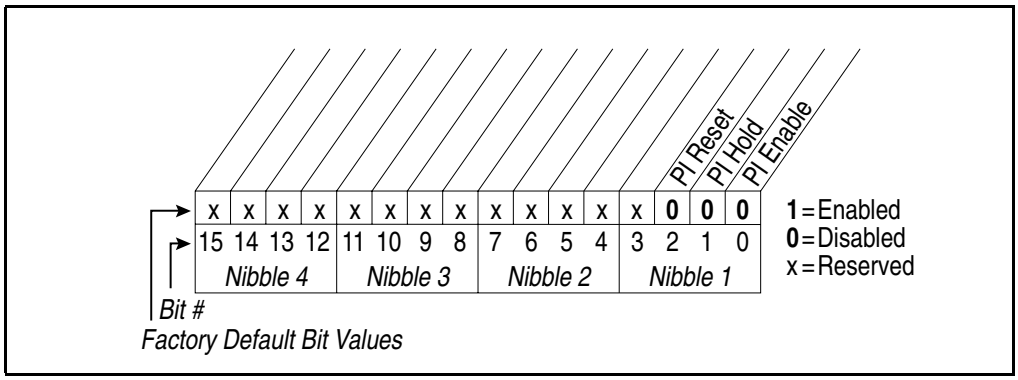

PI Reset
PI Hold
PI Enable
x x x x x x x x x x x x x 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Enabled
0 = Disabled
x = Reserved

Figure 3.6 – PI Control (125)

Bit 0 - PI Enable

- Enables/disables the operation of the PI loop.

Note: To use the PI loop, Bit 0 must be set to Enable (1), even if a digital input has been programmed to be used as a PI Enable (See parameters 361-366).

Bit 1 - PI Hold

- Enabled = The integrator for the outer control loop is held at the current level; that is, it will not increase.
- Disabled = The integrator for the outer PI control loop is allowed to increase.

Bit 2 - PI Reset

- Enabled = The integrator for the outer PI control loop is reset to zero.
- Disabled = The integrator for the outer PI control loop integrates normally.

126 PI Reference Sel

Range: 0 = Setpoint
1 = Analog In 1
2 = Analog In 2
3-6 = Reserved
7 = Pulse In
8 = Encoder
9 = MOP Level
10 = Master Ref
11 = Preset Spd 1
12 = Preset Spd 2
13 = Preset Spd 3
14 = Preset Spd 4
15 = Preset Spd 5
16 = Preset Spd 6
17 = Preset Spd 7
18 = Local HIM
19 = DPI Port 2
20 = DPI Port 3
21 = DPI Port 4
22 = Network
23-24 = Reserved
25 = Scale Block 1
26 = Scale Block 2
27 = Scale Block 3
28 = Scale Block 4

Default: 0 = PI Setpoint

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

Selects the source of the PI reference signal. Setting this parameter to 0 = PI Setpoint indicates PI Setpoint (127) is used.

127 PI Setpoint

Range: -/+100.00% of Maximum Process Value [0.01%]

Default: 50.00%

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

Provides an internal fixed value for the process setpoint when PI Reference Sel (126) is set to PI Setpoint.

128 PI Feedback Sel

Range:	0 = Setpoint 1 = Analog In 1 2 = Analog In 2 3-6 = Reserved 7 = Pulse In 8 = Encoder 9 = MOP Level 10 = Master Ref 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Preset Spd 7 18 = Local HIM 19 = DPI Port 2 20 = DPI Port 3 21 = DPI Port 4 22 = Network 23-24 = Reserved 25 = Scale Block 1 26 = Scale Block 2 27 = Scale Block 3 28 = Scale Block 4
Default:	0 = PI Setpoint
Access:	2 **Path:** Speed Command>Process PI
See also:	124-138

Selects the source of the PI feedback signal. Setting this parameter to 0 = PI Setpoint indicates PI Setpoint (127) is used.

129 PI Integral Time

Range:	0.00 to 100.00 sec [0.01 sec]
Default:	2.00 sec
Access:	2 **Path:** Speed Command>Process PI
See also:	124-138

Specifies the time required for the integral component to reach 100% of PI Error Meter (137). Not functional when the PI Hold bit of PI Control = 1 (Enabled).

130 PI Prop Gain

Range: 0.00 to 100.00 [0.01]

Default: 1.00

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

Sets the value for the PI proportional component when the PI Hold bit of PI Control (125) = Enabled (1).

PI Error x PI Prop Gain = PI Output

131 PI Lower Limit

Range: -/+400.0 Hz or -/+ 800.0% [0.1 Hz or .01%]

Default: -Maximum Freq or -100%

Access: 2 **Path:** Speed Command>Process PI

See also: 79, 124-138

Sets the lower limit of the PI output. This value must be less than the value set in PI Upper Limit (132).

132 PI Upper Limit

Range: -/+400.0 Hz or -/+ 800.0% [0.1 Hz or 0.1%]

Default: +Maximum Freq 0r 100%

Access: 2 **Path:** Speed Command>Process PI

See also: 79, 124-138

Sets the upper limit of the PI output. This value must be greater than the value set in PI Lower Limit (131).

133 PI Preload

Range: PI Lower Limit to PI Upper Limit [0.1 Hz or 0.1%]

Default: 0.0 Hz or 100%

Access: 2 **Path:** Speed Command>Process PI

See also: 79, 124-138

Sets the value used to preload the integral component on start or enable.

134 PI Status

Range: See figure 3.7

Default: Read Only

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

The present state of the process PI regulator.

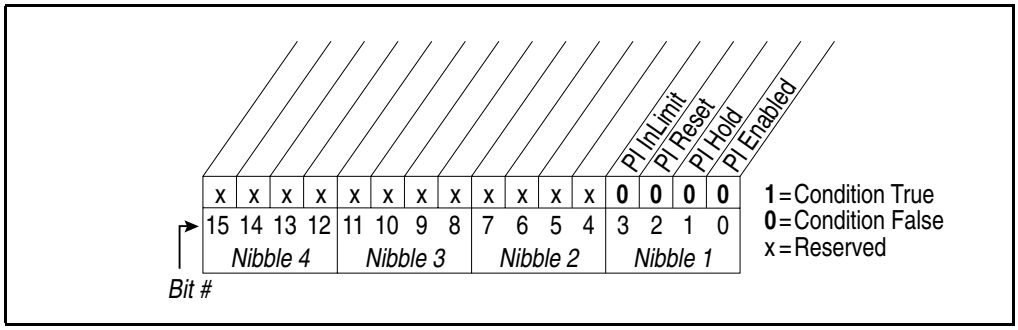

PI InLimit
PI Reset
PI Hold
PI Enabled
x x x x x x x x x x x x 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Figure 3.7 – PI Status (134)

Bit 0 - PI Enabled

- Indicates whether or not the PI loop is enabled.

Bit 1 - PI Hold

- Is set to 1 to indicate when a digital input is configured for PI Hold and is turned on, or the PI Hold bit is set in PI Control (125).

Bit 2 - PI Reset

- Is set to 1 to indicate when the PI Integrator is being reset to zero.

Bit 3 - PI InLimit

- Is set to 1 to indicate when the PI output equals positive limit or negative limit.

135 PI Ref Meter

Range: -/+100.0% [0.1%]

Default: Read Only

Access: 2 **Path:** Speed Command>Process PI

See also: 124 - 138

Present value of the PI reference signal.

136 PI Fdback Meter

Range: -/+100.0% [0.1%]

Default: Read Only

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

Present value of the PI feedback signal.

137 PI Error Meter

Range: -/+200.0% [0.1%]

Default: Read Only

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

Present value of the PI error signal.

138 PI Output Meter

Range: -/+ 100.0 Hz or -/+ 800.0% [0.1 Hz or 0.1%]

Default: Read Only

Access: 2 **Path:** Speed Command>Process PI

See also: 124-138

Present value of the PI output signal.

139 PI BW Filter

Range: 0.0 to 240.0 Radians [0.1 Radians]

Default: 0.0 Radians

Access: 2 **Path:** Speed Command>Process PI

See also: 137

Provides filter for Process PI error signal. The output of this filter is displayed in PI Error Meter (137). Zero will disable the filter.

.

140 Accel Time 1
141 Accel Time 2

Range: 0.0 to 3600.0 [0.1 sec]

Default: 10.0 secs

Access: 140=0 **Path:** Dynamic Control>Ramp Rates
141=2

See also: 142, 143, 146, 361

The Accel Time parameters set the rate at which the drive ramps to its output frequency after a start command or during an increase in command frequency (speed change). The rate established is the result of the following equation:

(Maximum Speed / Accel Time) = Accel Rate

Two accel times exist to enable acceleration rate changes “on the fly” using a building automation system command or digital input, if configured.

142 Decel Time 1
143 Decel Time 2

Range: 0.0 to 3600.0 sec [0.1 sec]

Default: 10.0 secs

Access: 142=0 **Path:** Dynamic Control>Ramp Rates
143=2

See also: 140, 141, 146, 361

Sets the rate of deceleration for all speed decreases.

(Max Speed / Decel Time) = Decel Rate

Two decel times exist to enable deceleration rate changes “on the fly” using a building automation system command or digital input, if configured.

145 DB While Stopped

Range: 0 = Disabled
1 = Enabled

Default: 0 = Disabled

Access: 2 **Path:** Dynamic Control>Stop/Brake Modes

See also: 161, 162

Enables/disables dynamic brake operation when drive is stopped. DB may operate when drive is stopped. DB may operate if input voltage becomes too high.

Disabled = DB will only operate when drive is running.

Enabled = DB will only operate when the drive is energized.

146 S Curve %

Range: 0 to 100% [0.1%]

Default: 0%

Access: 0 **Path:** Dynamic Control>Ramp Rates

See also: 140 - 143

Sets the percentage of acceleration or deceleration time that is applied to the ramp as S Curve. Time is added; 1/2 at the beginning and 1/2 at the end of the ramp.

147 Current Lmt Sel

Range: 0 = Curr Lim Val
1 = Analog In 1
2 = Analog In 2

Default: 0 = Cur Lim Val

Access: 2 **Path:** Dynamic Control>Load Limits

See also: 146, 149

Selects the source for the adjustment of current limit (i.e., parameter, analog input, etc.).

148 Current Lmt Val

Range: Based on Drive Type [0.1 Amps]

Default: Rated Amps x 1.5 (Yields approximate default value)

Access: 0 **Path:** Dynamic Control>Load Limits

See also: 147, 149

Defines the current limit value when Current Lmt Sel (147) = Cur Lim Val.

When in Adj Voltage mode, the output voltage will not be allowed the exceed this value.

149 Current Lmt Gain

Range: 0 to 5000 [1]

Default: 250

Access: 2 **Path:** Dynamic Control>Load Limits

See also: 147, 148

Sets the responsiveness of the current limit.

150 Drive OL Mode

Range: 0 = Disabled
1 = Reduce CLim
2 = Reduce PWM
3 = Both-PWM 1st

Default: 3 = Both-PWM 1st

Access: 1 **Path:** Dynamic Control>Load Limits

See also: 219

Selects the drive's response to increasing drive temperature and may reduce the current limit value as well as the PWM frequency. If the drive is being used with a sine wave filter, the filter is likely tuned to a specific carrier frequency. To ensure stable operation, it is recommended that Drive OL Mode be set to 1 = Reduce CLim.

151 PWM Frequency

FV

Range: 2 - 10kHz [2/4/8/10 kHz]

Default: 4 kHz
2 kHz (Frames 4-6, 575 VAC)

Access: 0 **Path:** Dynamic Control>Load Limits

See also:

Sets the carrier frequency for the PWM output. Drive derating may occur at higher carrier frequencies. For derating information, refer to Appendix A.

Important: If Motor Cntl Sel (53) is set to FVC Vector, the drive will run at 2kHz carrier frequency when operating below 6 Hz.

152 Droop RPM @ FLA

FV

Range: 0.0 to 200.0 RPM [0.1 RPM]

Default: 0.0 RPM

Access: 1 **Path:** Dynamic Control>Load Limits

See also:

Selects amount of droop that the speed reference is reduced when at full load torque. Zero disables the droop function.

Important: Selecting "Slip Comp" with Feedback Select (80) in conjunction with Droop RPM @ FLA may produce undesirable results.

153 Regen Power Limit

Range: -800.0 % to 0.0% [0.1%]
Default: -50.0%
Access: 1 **Path:** Dynamic Control>Load Limits
See also: 53

Sets the maximum power limit allowed to transfer from the motor to the DC Bus. When using an external dynamic brake, set Regen Power Limit to its maximum value.

154 Current Rate Lim

Range: 1.0% to 800.0% [0.1%]
Default: 400.0%
Access: 1 **Path:** Dynamic Control>Load Limits
See also:

Sets the largest allowable rate of change for the current reference signal. This number is scaled in percent of maximum motor current every 250 microseconds.

155 Stop Mode A
156 Stop Mode B

Range: 0 = Coast
1 = Ramp
2 = Ramp to Hold
3 = DC Brake
4 = Fast Brake

Default: 155: 1 = Ramp
156: 0 = Coast

Access: 155= 0 **Path:** Dynamic Control>Stop/Brake Modes
156= 2

See also: 157-159

Active stop mode. Stop Mode A is active unless Stop Mode B is selected by a digital input. See section 13.17 for more information.

ATTENTION: The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

157 DC Brake Lvl Sel

Range:	0 = DC Brake Lvl 1 = Analog In 1 2 = Analog In 2
Default:	0 = DC Brake Lvl
Access:	1 **Path:** Dynamic Control>Stop/Brake Modes
See also:	155, 156, 158, 159

Selects the source for DC Brake Level (158).

158 DC Brake Level

Range:	0 to (Rated Amps x 1.5) [0.1 Amps]
Default:	Rated Amps x 1.5
Access:	1 **Path:** Dynamic Control>Stop/Brake Modes
See also:	40, 157-159

Defines the maximum DC brake current level injected in the motor when “DC Brake” is selected as a stop mode.

The DC braking voltage used in this function is created by a PWM algorithm and may not generate the smooth holding force needed for some applications.

ATTENTION: If a hazard of injury due to movement of equipment or material exists, an auxiliary mechanical braking device must be used to stop the motor. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: This feature should not be used with synchronous or permanent magnet motors. Motors may be demagnetized during braking. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

159 DC Brake Time

Range:	0.0 to 90.0 sec [0.1 sec]
Default:	0.0 sec
Access:	1 **Path:** Dynamic Control>Stop/Brake Modes
See also:	155 - 158

Sets the amount of time DC brake current is “injected” into the motor.

160 Bus Reg Ki

Range: 0 to 5000 [1]

Default: 450

Access: 2 **Path:** Dynamic Control>Stop/Brake Modes

See also: 161, 162

Sets the responsiveness of the bus regulator.

161 Bus Reg Mode A
162 Bus Reg Mode B

Range:
0 = Disabled
1 = Adjust Freq
2 = Dynamic Brak
3 = Both - DB 1st
4 = Both - Frq 1st

Default: Mode A: 0 = Disabled
Mode B: 0 = Disabled

Access: 2 **Path:** Dynamic Control>Stop/Brake Modes

See also: 160, 163

Sets the method and sequence of the DC bus regulator voltage. Choices are dynamic brake, frequency adjust, or both.

Sequence is determined by programming or digital input to the terminal block.

If a dynamic brake resistor is connected to the drive, Bus Reg Mode A and Bus Reg Mode B must be set to option 2, 3, or 4.

ATTENTION: The adjust freq portion of the bus regulator function is extremely useful for preventing nuisance overvoltage faults resulting from aggressive decelerations, overhauling loads, and eccentric loads. It forces the output frequency to be greater than commanded frequency while the drive's bus voltage is increasing towards levels that would otherwise cause a fault. However, it can also cause either of the following two conditions to occur:

- Fast positive changes in input voltage (more than a 10% increase within 6 minutes) can cause uncommanded positive speed changes; however, an OverSpeed Limit fault will occur if the speed reaches Max Speed + Overspeed Limit. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive, and 2) limit fast positive input voltage changes to less than 10%. Without taking such actions, if this operation is unacceptable, the adjust freq portion of the bus regulator function must be disabled (see parameters 161 and 162).
- Actual deceleration times can be longer than commanded deceleration times; however, a Decel Inhibit fault is generated if the drive stops decelerating altogether. If this condition is unacceptable, the adjust freq portion of the bus regulator must be disabled (see parameters 161 and 162). In addition, installing a properly sized dynamic brake resistor will provide equal or better performance in most cases.

Note that these faults are not instantaneous and have shown test results that take between 2 and 12 seconds to occur.

163 DB Resistor Type

Range:	0 = Internal Res 1 = External Res 2 = None
Default:	2 = None
Access:	1 **Path:** Dynamic Control>Stop/Brake Modes
See also:	161, 162

Selects whether the internal or an external DB resistor will be used.

If a dynamic braking resistor is connected to the drive, Bus Reg Mode A and B (161 and 162) must be set to option 2, 3 or 4.

ATTENTION: Equipment damage may result if a drive mounted (internal) resistor is installed and this parameter is set to "External Res" or "None." Thermal protection for the internal resistor will be disabled, resulting in possible device damage. Failure to observe this precaution could result in equipment damage.

164 Bus Reg Kp

Range: 0 to 10000
Default: 1500
Access: 2 **Path:** Dynamic Control>Stop/Brake Modes
See also:

Proportional gain for the bus regulator. Used to adjust regulator response.

165 Bus Reg Kd

Range: 0 to 10000
Default: 1000
Access: 2 **Path:** Dynamic Control>Stop/Brake Modes
See also:

Derivative gain for the bus regulator. Used to control regulator overshoot.

166 Flux Braking

Range: 0 = Disabled
1 = Enabled
Default: 0 = Disabled
Access: 2 **Path:** Dynamic Control>Stop/Brake Modes
See also:

Set to use an increase in the motor flux current to increase the motor losses, and allow a faster deceleration time when a chopper brake or regenerative capability is not available. Flux Braking can be used as a stopping or fast deceleration method.

167 Powerup Delay

Range: 0.0 to 10800.0 Secs [0.1 Sec]
Default: 0.0 Secs
Access: 1 **Path:** Dynamic Control>Restart Modes
See also:

Defines the programmed delay time, in seconds, before a start command is accepted after a power up.

168 Start At PowerUp

Range: 0 = Disabled
1 = Enabled
Default: 0 = Disabled
Access: 2 **Path:** Dynamic Control>Restart Modes
See also:

Enables/disables a feature to issue a Start or Run command and automatically resume running at commanded speed after drive input power is restored.

When enabled, Start At PowerUp requires a digital input configured and closed for Run or Start and a valid start contact.

ATTENTION: Be aware of the following:

- Setting parameter 168 to 1 (Enabled) immediately applies output power to the motor when all start conditions are met.
- If the drive is running from the terminal block, Start At PowerUp is enabled, and a fault occurs, the drive coasts to rest and generates a fault. In this case, resetting and clearing the fault immediately restarts the drive without any change to the start or stop input states.

When this function is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

169 Flying Start En

Range:	0 = Disabled 1 = Enabled
Default:	0 = Disabled
Access:	2 **Path:** Dynamic Control>Restart Modes
See also:	170

Enables/disables the function which reconnects to a spinning motor at actual RPM when a start command is issued.

Flying Start En is not required in FVC Vector mode when using an encoder.

170 Flying StartGain

Range:	20 to 32767 [1]
Default:	4000
Access:	2 **Path:** Dynamic Control>Restart Modes
See also:	169

Adjusts the responsiveness of the flying start function. Increasing the value in this parameter increases the responsiveness of the flying start function.

Important: Lower gain may be required for permanent magnet motors.

174 Auto Rstrt Tries

Range:	0 to 9 [1]
Default:	0 (Disabled)
Access:	1 **Path:** Dynamic Control>Restart Modes
See also:	175

ATTENTION: Equipment damage and/or personal injury may result if parameter 174 is used in an inappropriate application. Do not use this function without considering applicable local, national, and international codes, standards, regulations, or industry guidelines.

ATTENTION: The drive may start immediately after a fault is auto-reset when Start At PowerUp (168) is set to Enabled.

When Start At PowerUp is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the drive equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

Important: The drive will re-start after a reset if the start input is still asserted.

Specifies the maximum number of times the drive attempts to reset a fault and restart when the auto restart feature is enabled.

The auto restart feature provides the ability for the drive to automatically perform a fault reset followed by a start attempt without user or application intervention. Only certain faults are permitted to be reset.

When the auto restart feature is enabled (that is, Auto Rstrt Tries is set to a value greater than zero), and an auto-resettable fault occurs, the drive will stop. After the number of seconds in Auto Restrt Delay (175) has elapsed, the drive will automatically reset the faulted condition. The drive will then issue an internal start command to start the drive.

If another auto-resettable fault occurs, the cycle will repeat up to the number of attempts specified in Auto Rstrt Tries.

If the drive faults repeatedly for more than the number of attempts specified in Auto Rstrt Tries with less than five minutes between each fault, the drive will remain in the faulted state. The fault Auto Rstrt Tries will be logged in the fault queue.

The auto restart feature is disabled when the drive is stopping and during autotuning. Note that a DC Hold state is considered stopping.

The following conditions will abort the reset/run process:

- Issuing a stop command from any control source. (Note that removal of a 2-wire run-fwd or run-rev command is considered a stop command.)
- Issuing a fault reset command from any active source.

- Removing the enable input signal.
- Setting Auto Restrt Tries to zero.
- Occurrence of a fault that is not auto-resettable.
- Removing power from the drive.
- Exhausting an auto-reset/run cycle.

175 Auto Rstrt Delay

Range: 0.5 to 10800.0 sec [0.1 sec]
Default: 1.0 sec
Access: 1 **Path:** Dynamic Control>Restart Modes
See also: 174

Sets the time between restart attempts when the auto restart feature is enabled. Refer to Auto Rstrt Tries (174) for more information about the auto restart feature.

177 Gnd Warn Level

Range: 1.0 to 5.0 Amps [0.1 Amps]
Default: 3.0 Amps
Access: 2 **Path:** Dynamic Control>Power Loss
See also: 174

Sets the level at which a ground warning fault will occur. Configure with Alarm Config 1 (259).

178 Sleep-Wake Mode

Range: 0 = Disabled
1 = Direct (Enabled)
2 = Invert (Enabled)
Default: 0 = Disabled
Access: 1 **Path:** Dynamic Control>Restart Modes
See also:

Enables the Sleep-Wake function.

Important: When enabled, the following conditions must be met:

- A proper value must be programmed for Wake Level (180) and Sleep Level (182).
- A speed reference must be selected in Speed Ref A Sel (90).
- At least one of the following must be programmed (and input closed) in Digital Inx Sel (361-366): Enable, Stop-CF, Run, Run Forward, Run Reverse.

ATTENTION: Enabling the Sleep-Wake function can cause unexpected machine operation during the Wake mode. Failure to observe these precautions can result in damage to the equipment and/or personal injury.

Table 3.2 – Conditions Required to Start Drive when Sleep-Wake is Enabled[1] [2] [3]

Configured Digital Input(s)	After Power-Up	After Fault		After Stop
		Stop-CF Cmd (HIM or TermBlk)	Clear Faults Cmd (TB or V*S Utilities)	HIM, TB, or Network Stop
Stop	Stop Closed Wake Signal	Stop Closed Wake Signal Start/Run Cmd[4]	Stop Closed	Stop Closed Direct Mode: Analog Sig>Sleep Level[5] Invert Mode: Analog Sig<Sleep Level[5] Start/Run Cmd
Enable	Enable Closed Wake Signal	Enable Closed Wake Signal Start/Run Cmd[4]	Enable Closed Wake Signal	Enable Closed Direct Mode: Analog Sig>Sleep Level[5] Invert Mode: Analog Sig<Sleep Level[5] Start/Run Cmd
Run Run For. Run Rev.	Run Closed Wake Signal	Run Cmd[4] Wake Signal	Run Closed Wake Signal	Run Cmd[4] Wake Signal

[1] When power is cycled, restart will occur if all conditions above are met.
[2] When Sleep-Wake Mode is enabled, drive start will occur if all conditions above are met.
[3] The Sleep-Wake function and Speed Reference may be assigned to the same analog input.
[4] Start/Run Cmd must be cycled.
[5] Signal does not have to be greater than Wake level.

179 Sleep-Wake Ref

Range: 1 = Analog In 1
2 = Analog In 2

Default: 2 = Analog In 2

Access: 1 **Path:** Dynamic Control>Restart Modes

See also:

Selects the source of the input controlling the Sleep-Wake function.

180 Wake Level

Range: Sleep Level / 20.000 mA, 10.000 volts [0.001 mA, 0.001 V]

Default: 6.000 mA, 6.000 V

Access: 1 **Path:** Dynamic Control>Restart Modes

See also: 181

Defines the analog input level that will start the drive.

181 Wake Time

Range:	0.0 to 1000.0 Secs [0.1 sec]
Default:	0.0 sec
Access:	1 **Path:** Dynamic Control>Restart Modes
See also:	180

Defines the amount of time at or above Wake Level before a start command is issued.

182 Sleep Level

Range:	4.000 mA, 0.000 V / Wake Level [0.001 mA, 0.001 V]
Default:	5.000 mA, 5.000 V
Access:	1 **Path:** Dynamic Control>Restart Modes
See also:	183

Defines the analog input level that will stop the drive.

183 Sleep Time

Range:	0.0 to 1000.0 secs [0.1 sec]
Default:	0.0 sec
Access:	1 **Path:** Dynamic Control>Restart Modes
See also:	182

Defines the amount of time at or below Sleep Level before a stop command is issued.

184 Power Loss Mode

Range:	0 = Coast 1 = Decel 2 = Continue 3 = Coast input 4 = Decel input
Default:	0 = Coast
Access:	1 **Path:** Dynamic Control>Power Loss
See also:	13, 184

Sets the reaction to a loss of input power. Power loss is recognized when:

DC bus voltage is ≤73% of DC Bus Memory and Power Loss Mode is set to Coast. DC bus voltage is ≤82% of DC Bus Memory and Power Loss Mode is set to Decel.

185 Power Loss Timer

Range: 0.0 to 60.0 sec [0.1 sec]
Default: 0.5 sec
Access: 1 Path: Dynamic Control>Power Loss
See also: 184

Sets the time that the drive will remain in power loss mode before a fault is issued.

186 Power Loss Level

Range: 0.0 to 999.9 [0.1 VDC]
Default: Drive Rated Volts
Access: 1 Path: Dynamic Control>Power Loss
See also:

When set to a non-zero value, selects the change in level at which the Power Loss will occur.

The drive can use the percentages referenced in Power Loss Mode (184) or a trigger point can be set for the line loss detection as follows:

$V_{Trigger}$ = [DC Bus Memory] - [Power Loss Level]

A digital input (programmed to 29 = Pwr Loss Lvl) is used to toggle between fixed percentages and the detection level.

ATTENTION: If the value for Power Loss Level (186) is greater than 18% of DC Bus Memory (13), the user must provide a minimum line impedance to limit inrush current when the power line recovers. The input impedance should be equal to or greater than the equivalent of a 5% transformer with a VA rating 5 times the drive input VA rating. Failure to observe this precaution could result in damage to equipment.

187 Load Loss Level

Range: 0.0 to 800.0% [0.1%]
Default: 200.0%
Access: 2 Path: Dynamic Control>Power Loss
See also: 211, 259

Sets the percentage of motor nameplate torque at which a load loss alarm will occur.

188 Load Loss Time

Range:	0.0 to 30.0 secs [0.1 sec]
Default:	0.0 secs
Access:	2 Path: Dynamic Control>Power Loss
See also:	187

Sets the time that current is below the level set in Load Loss Level (188) before a fault occurs.

189 Shear Pin Time

Range:	0.0 to 30.0 secs [0.1 sec]
Default:	0.0 secs
Access:	1 Path: Dynamic Control>Load Limits
See also:	238

Sets the time that the drive is at or above current limit before a fault occurs. Zero disables this feature.

190 Direction Mode

Range:	0 = Unipolar 1 = Bipolar 2 = Reverse Dis
Default:	0 = Unipolar
Access:	0 **Path:** Utility>Direction Config
See also:	91, 92, 320 - 327, 361 - 366

Selects the source for control of drive direction.

ATTENTION: When using bipolar analog inputs, unpredictable changes in motor speed and direction can be caused by noise and drift in sensitive circuits. Use speed command parameters to help reduce input source sensitivity. Failure to observe this precaution could result in bodily injury or damage to equipment.

ATTENTION: Setting parameter 190 to 0 or 1 may cause unwanted motor direction. Verify driven machinery cannot be damaged by reverse rotation before changing the setting of this parameter to 0 or 1. Failure to observe this precaution could result in damage to, or destruction of, equipment.

Unipolar = Drive receives unsigned reference (0 to 32767) and direction command separately (from the DPI port). For example, the direction keys on an HIM apply the direction to the reference.

Bipolar = Drive receives signed reference (-32767 to 32767). In this case, the direction keys have no effect.

Reverse Disable = Drive receives signed reference (-32767 to 32767); however, regardless of the reference, the drive is not permitted to reverse.

192 Save HIM Ref

Range: See figure 3.8

Default: See figure 3.8

Access: 2 **Path:** Utility>HIM Ref Config

See also:

Allows configuration of the operation of all attached HIM devices (independent of Logic Source Sel (89)). Upper word (bits 16-31) are reserved.

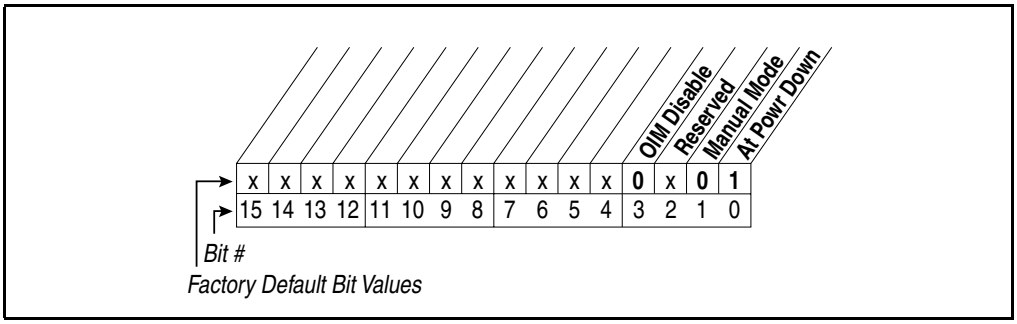

OIM Disable
Reserved
Manual Mode
At Powr Down
x x x x x x x x x x x x 0 x 0 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values

Figure 3.8 – Save HIM Ref (192)

At Power Down:

Inactive = Preload HIM reference with zero at power-up.
Active = Save HIM references at power down and preload them at power-up.

Manual Mode:

Inactive = Transition from Auto to Manual causes only reference to be controlled from the requesting HIM.

Active = Transition from Auto to Manual causes reference and control (Start, Jog, Direction, Clear Faults) to be controlled from the requesting HIM.

HIM Disable:

Inactive: HIM Start, Jog, Direction, and Clear Fault commands are functional.
Active: HIM Start, Jog, Direction, and Clear Fault commands are disabled.

193 Man Ref Preload

Range: 0 = Disabled
1 = Enabled

Default: 1 = Enabled

Access: 2 **Path:** Utility>HIM Ref Config

See also:

Enables/disables a feature to automatically load the present auto frequency reference value into the HIM when Manual is selected. Allows smooth speed transition from Auto to Manual.

194 Save MOP Ref

Range: See figure 3.9

Default: See figure 3.9

Access: 2 **Path:** Utility>MOP Config

See also:

Enables/disables the feature that saves the present MOP (motor-operated potentiometer) frequency reference at power down or at stop.

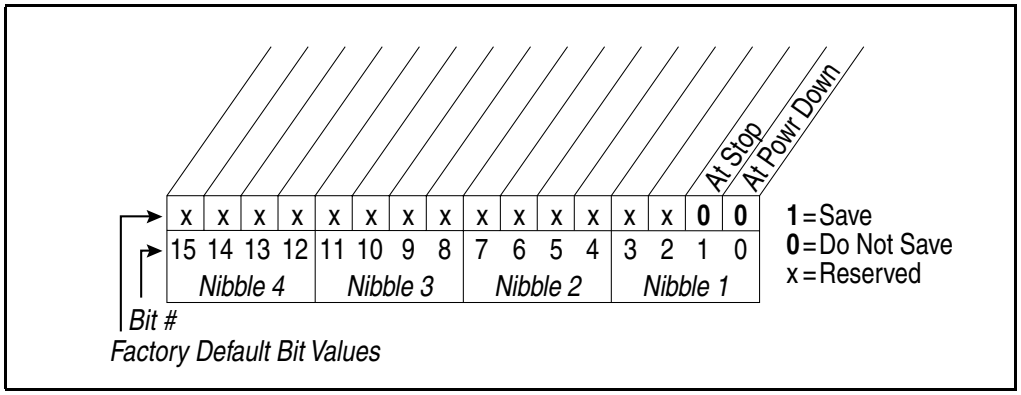

At Stop
At Powr Down
x x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Save
0 = Do Not Save
x = Reserved

Figure 3.9 – Save MOP Ref (194)

195 MOP Rate

Range: 0.2 to Maximum Frequency [0.1 Hz/sec]
6.0 to Maximum Frequency [0.1 RPM/sec]

Default: 1.0 Hz/sec or 30.0 RPM/sec

Access: 2 **Path:** Utility>MOP Config

See also:

Sets the rate of change of the MOP reference in response to a digital input.

196 Param Access Lvl

Range: 0 = Basic
1 = Standard
2 = Advanced

Default: 0 = Basic

Access: 2 **Path:** Utility>Drive Memory

See also:

Displays the present parameter access level.

The value of this parameter is not affected by a “Reset Defalts” command.

197 Reset to Defalts

Range: 0 = Ready
1 = Factory
2 = Low Voltage
3 = High Voltage

Default: 0 = Ready

Access: 0 **Path:** Utility>Drive Memory

See also: 41-47, 54, 55, 62, 63, 69-72, 82, 148, 158

Resets all parameter values to defaults except Language (201), Param Access Lvl (196), Voltage Class (202) and Torq Prove Cnfg (600).

- Option 1 resets the drive to factory settings based on Voltage Class.
- Options 2 and 3 resets the drive to factory settings and sets alternate voltage and current ratings.

Important: For Frames 5 and 6, the internal fan voltage may have to be changed when using Option 2 or 3.

198 Load Frm Usr Set

Range: 0 = Ready
1 = User Set 1
2 = User Set 2
3 = User Set 3

Default: 0 = Ready

Access: 1 **Path:** Utility>Drive Memory

See also: 199

Loads a previously saved set of parameter values from a selected user set location in drive non-volatile memory to active drive memory.

ATTENTION: The Reach Drive can be configured to use multiple saved parameter (user) sets. Caution must be utilized to ensure that each user set is programmed for proper operation for the application. Recalling an improperly programmed user set may cause rotation of the motor in an undesired direction at unexpected speeds or may cause unpredictable starting of the drive and motor. Failure to observe this precaution could result in damage to equipment, severe bodily injury or loss of life.

This parameter is disabled while Dynamic User Set mode is active. Dyn UserSet Cnfg (204), Dynamic Mode bit (0) = Enabled (1).

199 Save To User Set

Range:	0 = Ready 1 = User Set 1 2 = User Set 2 3 = User Set 3
Default:	0 = Ready
Access:	1 **Path:** Utility>Drive Memory
See also:	198

Saves the parameter values in active drive memory to a user set in drive non-volatile memory.

200 Reset Meters

Range:	0 = Ready 1 = MWh 2 = Elapsed Time
Default:	0 = Ready
Access:	1 **Path:** Utility>Drive Memory
See also:	

Resets selected meters to zero.

201 Language

Range:	0 = Not Selected 1 = English 2 = Francais 3 = Espanol 4 = Italiano 5 = Deutsch 7 = Portugues 10 = Nederlands
Default:	0 = Not Selected
Access:	2 **Path:** Utility>Drive Memory
See also:	

Selects the display language when using an LCD HIM. Options 6, 8 and 9 are reserved.

202 Voltage Class

Range:	2 = Low Voltage 3 = High Voltage 4-5 = Reserved
Default:	Based on Drive Type
Access:	2 **Path:** Utility>Drive Memory
See also:	41-47, 54, 55, 62, 63, 69-72, 82, 148, 158

Resets selected parameters that change the drive voltage rating, current rating, scaling, and motor data. Maximum, Minimum and Default values for parameters 41-47, 54, 55, 62, 63, 69-72, 82, 148 and 158 will be affected by changing this parameter.

203 Drive Checksum

Range:	0 to 65535 [1]
Default:	Read Only
Access:	2 **Path:** Utility>Drive Memory
See also:	

Provides a checksum value that indicates whether or not a change in drive programming has occurred (data values only).

204 Dyn UserSet Cnfg

Range:	See figure 3.10
Default:	See figure 3.10
Access:	2 **Path:** Utility>Drive Memory
See also:	

Enables/Disables dynamic selection of user parameter sets.

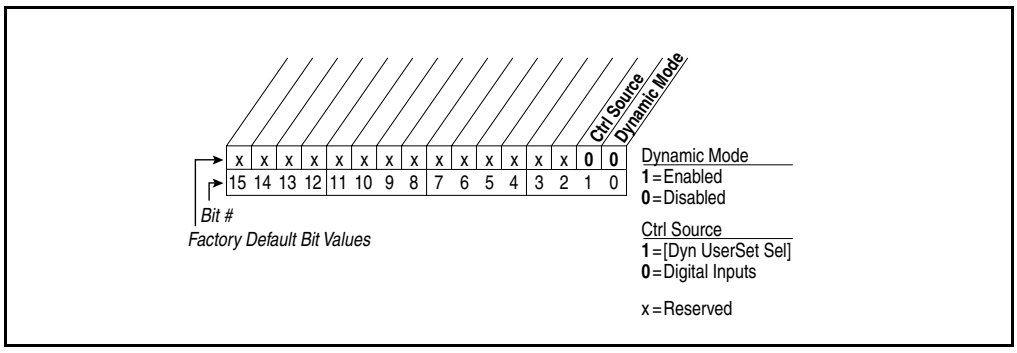

Ctrl Source
Dynamic Mode
x x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values
Dynamic Mode
1 = Enabled
0 = Disabled
Ctrl Source
1 = [Dyn UserSet Sel]
0 = Digital Inputs
x = Reserved

Figure 3.10 – Dyn UsrSet Cnfg

ATTENTION: The Reach Drive can be configured to use multiple saved parameter (user) sets. Caution must be utilized to ensure that each user set is programmed for proper operation for the application. Recalling an improperly programmed user set may cause rotation of the motor in an undesired direction at unexpected speeds or may cause unpredictable starting of the drive and motor. Failure to observe this precaution could result in damage to equipment, severe bodily injury or loss of life.

Important: In Dynamic Mode, changes to the parameters are not saved to nonvolatile storage. Switching user sets restores the values last saved before enabling dynamic mode.

205 Dyn UserSet Sel

Range: See figure 3.11

Default: See figure 3.11

Access: 2 **Path:** Utility>Drive Memory

See also:

Selects user set if Dyn UserSet Cnfg = xxxx xx11.

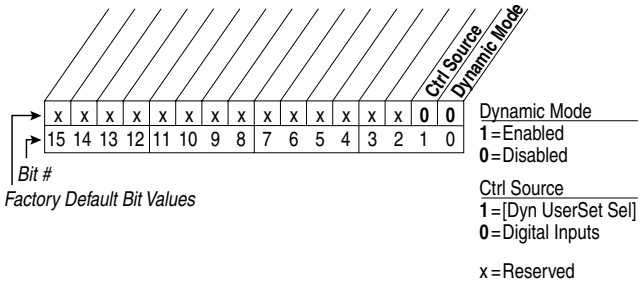

Ctrl Source
Dynamic Mode
x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values
Dynamic Mode
1 = Enabled
0 = Disabled
Ctrl Source
1 = [Dyn UserSet Sel]
0 = Digital Inputs
x = Reserved

Figure 3.11 – Dyn UsrSet Sel

ATTENTION: The Reach Drive can be configured to use multiple saved parameter (user) sets. Caution must be utilized to ensure that each user set is programmed for proper operation for the application. Recalling an improperly programmed user set may cause rotation of the motor in an undesired direction at unexpected speeds or may cause unpredictable starting of the drive and motor. Failure to observe this precaution could result in damage to equipment, severe bodily injury or loss of life.

206 Dyn UserSet Actv

Range: See figure 3.12

Default: Read Only

Access: 2 **Path:** Utility>Drive Memory

See also:

Indicates the active user set and if the operation of the user set is dynamic or normal.

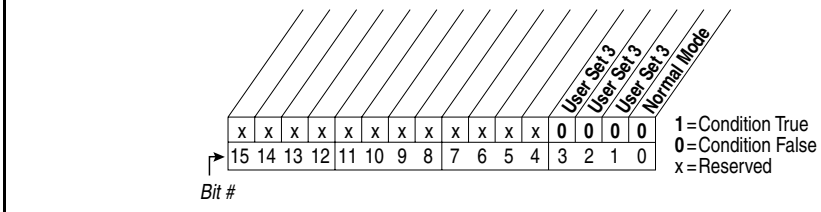

User Set 3
User Set 3
User Set 3
Normal Mode
x x x x x x x x x x x x 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Figure 3.12 – Dyn UserSet Actv

209 Drive Status 1

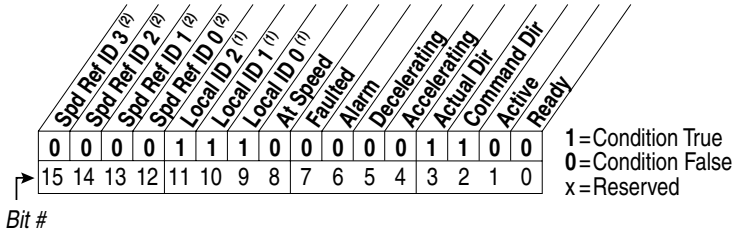
Range: See figure 3.13

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 210

Present operating condition of the drive.


Spd Ref ID 3 (2)
Spd Ref ID 2 (2)
Spd Ref ID 1 (2)
Spd Ref ID 0 (2)
Local ID 2 (1)
Local ID 1 (1)
Local ID 0 (1)
At Speed
Faulted
Alarm
Decelerating
Accelerating
Actual Dir
Command Dir
Active
Ready
0 0 0 0 1 1 1 0 0 0 0 0 1 1 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Bits (2)					Bits (1)			
15	14	13	12	Description	11	10	9	Description
0	0	0	0	Ref A Auto	0	0	0	Port 0 (TB)
0	0	0	1	Preset 1 Auto	0	0	1	Port 1
0	0	1	0	Preset 2 Auto	0	1	0	Port 2
0	0	1	1	Preset 3 Auto	0	1	1	Port 3
0	1	0	0	Preset 4 Auto	1	0	0	Port 4
0	1	0	1	Preset 5 Auto	1	0	1	Port 5
0	1	1	0	Preset 6 Auto	1	1	0	Port 6
0	1	1	1	Preset 7 Auto	1	1	1	No Local Control
1	0	0	0	TB Manual				
1	0	0	1	Port 1 Manual				
1	0	1	0	Port 2 Manual				
1	0	1	1	Port 3 Manual				
1	1	0	0	Port 4 Manual				
1	1	0	1	Port 5 Manual				
1	1	1	0	Port 6 Manual				
1	1	1	1	Jog Ref				

Figure 3.13 – Drive Status 1 (209)

210 Drive Status 2

Range: See figure 3.14

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 209

Present operating condition of the drive.

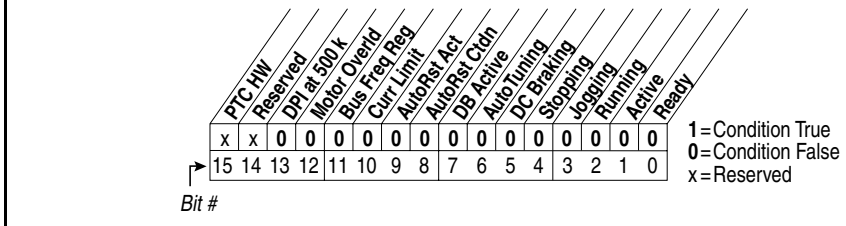


Figure 3.14 – Drive Status 2 (210)

211 Drive Alarm 1

Range: See figure 3.15

Default: Read Only

Access: 1 **Path:** Utility>Diagnostics

See also: 212

Indicates Type 1 alarm conditions that currently exist in the drive. Note that for alarm conditions not configured in Alarm Config 1 (259), the status indicated will be a zero.

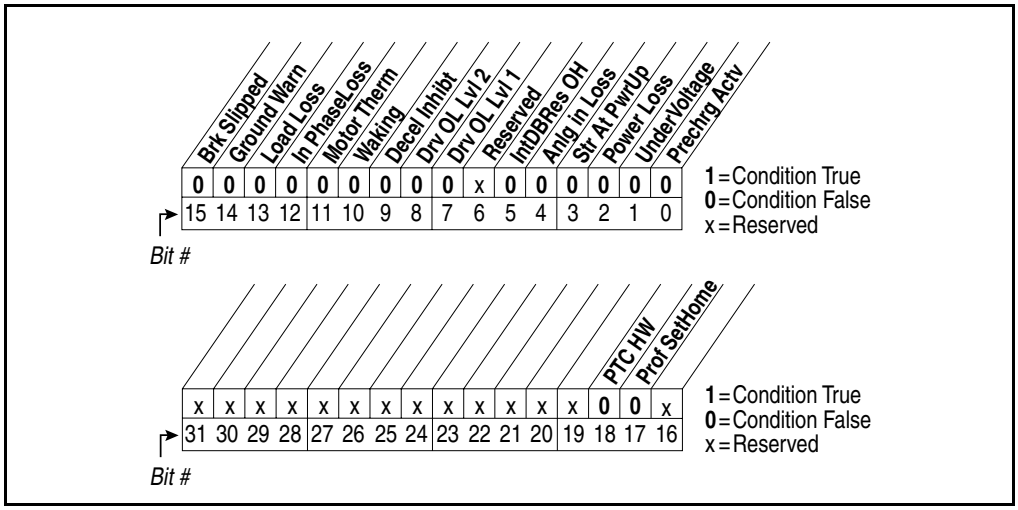

Brk Slipped
Ground Warn
Load Loss
In PhaseLoss
Motor Therm
Waking
Decel Inhibt
Drv OL Lvl 2
Drv OL Lvl 1
Reserved
IntDBRes OH
Anlg in Loss
Str At PwrUp
Power Loss
UnderVoltage
Prechrg Actv
0 0 0 0 0 0 0 0 0 x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
PTC HW
Prof SetHome
x x x x x x x x x x x x x 0 0 x
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Figure 3.15 – Drive Alarm 1 (211)

212 Drive Alarm 2

Range:	See figure 3.16		
Default:	Read Only		
Access:	1	**Path:**	Utility>Diagnostics
See also:	211		

Indicates Type 2 alarm conditions that currently exist in the drive.

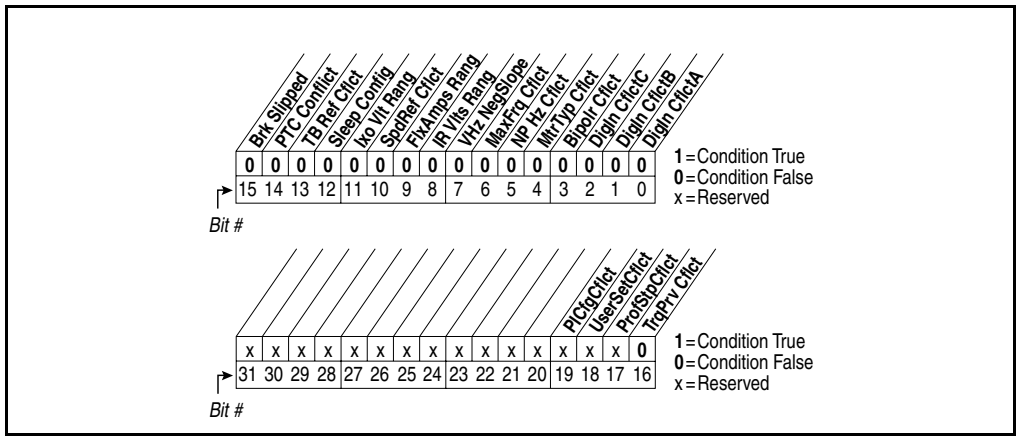

Brk Slipped
PTC Conflict
TB Ref Cflct
Sleep Config
Ixo Vlt Rang
SpdRef Cflct
FlxAmps Rang
IR Vlts Rang
VHz NegSlope
MaxFrq Cflct
NP Hz Cflct
MtrTyp Cflct
BipolR Cflct
DiglnCflctC
DiglnCflctB
DiglnCflctA
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Condition True
0 = Condition False
x = Reserved
PlCtgCflct
UserSetCflct
ProfStpCflct
TrqPrv Cflct
x x x x x x x x x x x x x x x 0
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Figure 3.16 – Drive Alarm 2 (212)

213 Speed Ref Source

Range: 0 = PI Output
1 = Analog In 1
2 = Analog In 2
3-6 = Reserved
7 = Pulse In
8 = Encoder
9 = MOP Level
10 = Jog Speed
11 = Preset Spd 1
12 = Preset Spd 2
13 = Preset Spd 3
14 = Preset Spd 4
15 = Preset Spd 5
16 = Preset Spd 6
17 = Preset Spd 7
18 = Local HIM
19 = DPI Port 2
20 = DPI Port 3
21 = DPI Port 4
22 = Network
23 = Reserved
24 = Auto Tune
25 = Jog Speed 2
26 = Scale Block 1
27 = Scale Block 2
28 = Scale Block 3
29 = Scale Block 4
30 = Pos/Spd Ref
31 = Position Reg
32 = Micro Pos
33 = Homing
34 = Decel Switch
35 = End Switch
36 = Unipolar Lim
37 = Rev Dis Lim
38 = Max Spd Lim
39 = Min Spd Lim
40 = Rev Spd Lim
41 = Load Trq Lim

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 90, 93, 96, 101

Displays the source of the speed reference of the drive.

214 Start Inhibits

Range: See figure 3.17

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also:

Displays the inputs currently preventing the drive from starting.

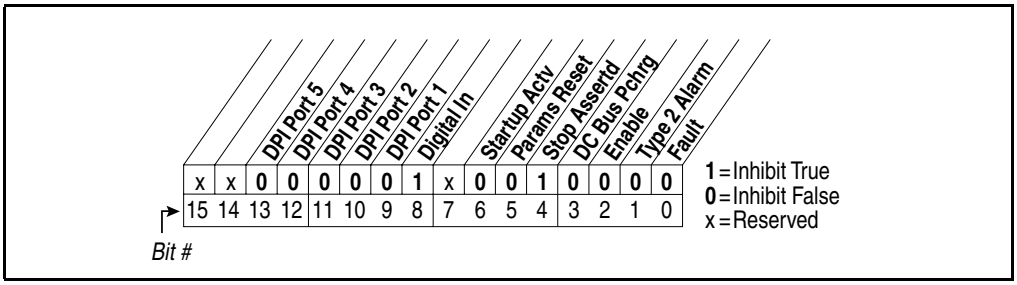

DPI Port 5
DPI Port 4
DPI Port 3
DPI Port 2
DPI Port 1
Digital In
Startup Actv
Params Reset
Stop Asserted
DC Bus Pchrg
Enable
Type 2 Alarm
Fault
x x 0 0 0 0 0 1 x 0 0 1 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Inhibit True
0 = Inhibit False
x = Reserved

Figure 3.17 – Start Inhibits (214)

215 Last Stop Source

Range: 0 = Pwr Removed
1 = Local HIM
2 = DPI Port 2
3 = DPI Port 3
4 = Reserved
5 = Network
6 = Reserved
7 = Digital In
8 = Fault
9 = Not Enabled
10 = Sleep
11 = Jog
12 = Autotune
13 = Precharge

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 361-366

Displays the source that initiated the most recent stop sequence. It will be cleared (set to 0) during the next start sequence.

216 Dig In Status

Range: See figure 3.18

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics
Inputs & Outputs> Digital Inputs

See also: 361-366

Current state of the digital inputs on the terminal block.

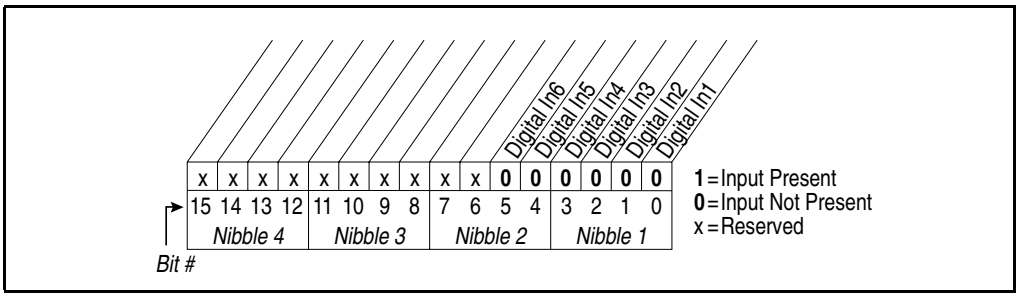

Digital In6
Digital In5
Digital In4
Digital In3
Digital In2
Digital In1
x x x x x x x x x x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Input Present
0 = Input Not Present
x = Reserved

Figure 3.18 – Dig In Status (216)

217 Dig Out Status

Range: See figure 3.19

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics
Inputs & Outputs>Digital Outputs

See also: 380-384

Current state of the digital outputs.

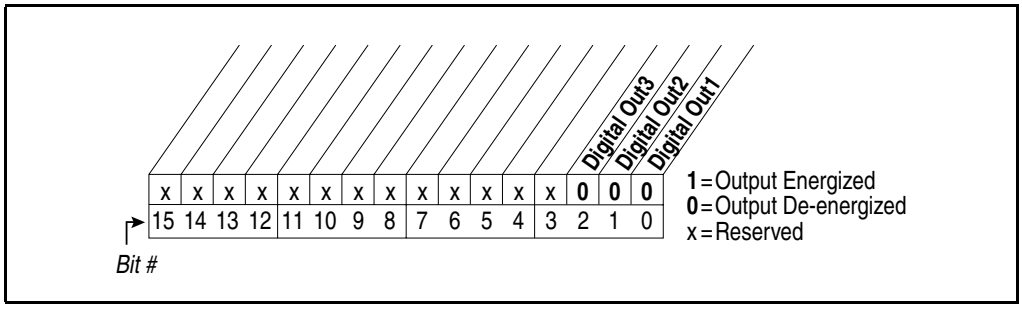

Digital Out3
Digital Out2
Digital Out1
x x x x x x x x x x x x x 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Output Energized
0 = Output De-energized
x = Reserved

Figure 3.19 – Dig Out Status (276)

218 Drive Temp

Range: 0 to 100.0 degC [0.1 degC]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also:

Present operating temperature of the drive power section.

219 Drive OL Count

Range: 0.0 to 100.0% [0.1%]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 150

Accumulated percentage of drive overload. Continuously operating the drive over 100% of its rating will increase this value to 100% and cause a drive fault.

220 Motor OL Count

Range: 0.0 to 100.0% [1.0%]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 47, 48

Accumulated percentage of motor overload. Continuously operating the motor over 100% of the motor overload setting will increase this value to 100% and cause a drive fault.

221 Mtr OL Trip Time

Range: 0.0 to 99999 [1]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 220

Amount of time before a Drive Overload fault occurs if the load condition remains constant. A value of 99999 means that the drive is operating under the overload level.

224 Fault Speed

Range: 0.0 to +Maximum Freq [0.1 Hz]
0.0 to +Maximum Speed [0.1 RPM]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 79, 225-230

Captures and displays the output speed of the drive at the time of the last fault.

225 Fault Amps

Range: 0.0 to Rated Amps x 2 [0.1 Amps]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 224-230

Captures and displays motor amps at the time of the last fault.

226 Fault Bus Volts

Range: 0.0 to Max Bus Volts [0.1 VDC]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 224-230

Captures and displays the DC bus voltage of the drive at the time of the last fault.

227 Status 1 @ Fault

Range: See figure 3.20

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 209, 224-230

Captures and displays Drive Status 1 bit pattern at the time of the last fault.

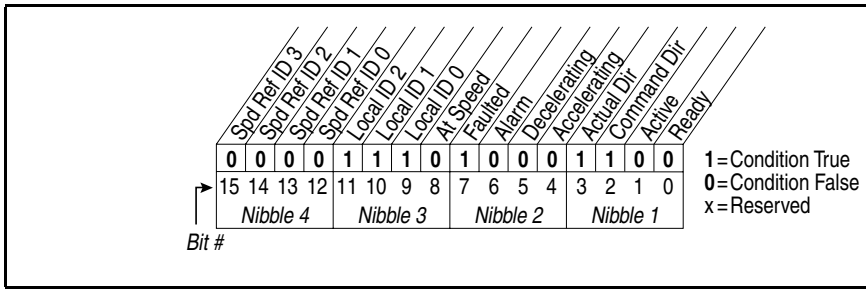


Figure 3.20 – Status 1 @ Fault (227)

228 Status 2 @ Fault

Range: See figure 3.21

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 210, 224-230

Captures and displays Drive Status 2 bit pattern at the time of last fault.

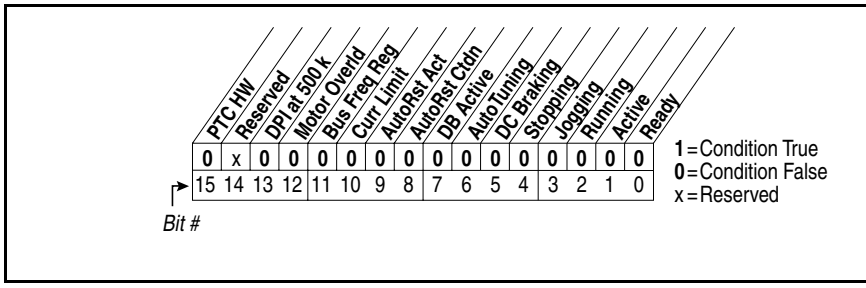


Figure 3.21 – Status 2 @ Fault (228)

229 Alarm 1 @ Fault

Range: See figure 3.22

Default: Read Only

Access: 1 **Path:** Utility>Diagnostics

See also: 211, 224-230

Captures and displays Drive Alarm 1 at the time of the last fault.

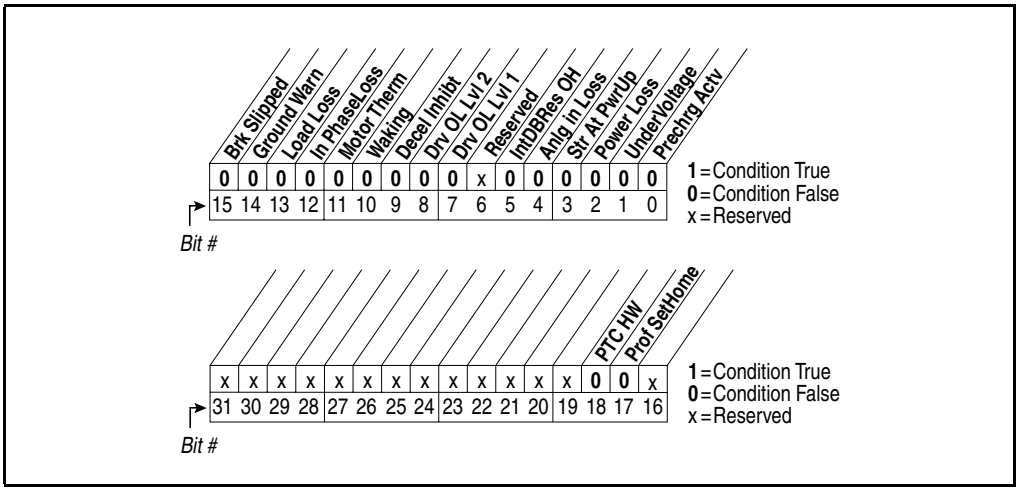

Brk Slipped
Ground Warn
Load Loss
In PhaseLoss
Motor Therm
Waking
Decel Inhibt
Drv OL Lvl 2
Drv OL Lvl 1
Reserved
IntDBRes OH
Anlg In Loss
Str At PwrUp
Power Loss
UnderVoltage
Prechrg Actv
0 0 0 0 0 0 0 0 0 x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Condition True
0 = Condition False
x = Reserved
PTC HW
Prof SetHome
x x x x x x x x x x x x x 0 0 x
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Figure 3.22 – Alarm 1 @ Fault (229)

230 Alarm 2 @ Fault

Range: See figure 3.23

Default: Read Only

Access: 1 **Path:** Utility>Diagnostics

See also: 211, 221-230

Captures and displays Drive Alarm 2 bit pattern at the time of last fault.

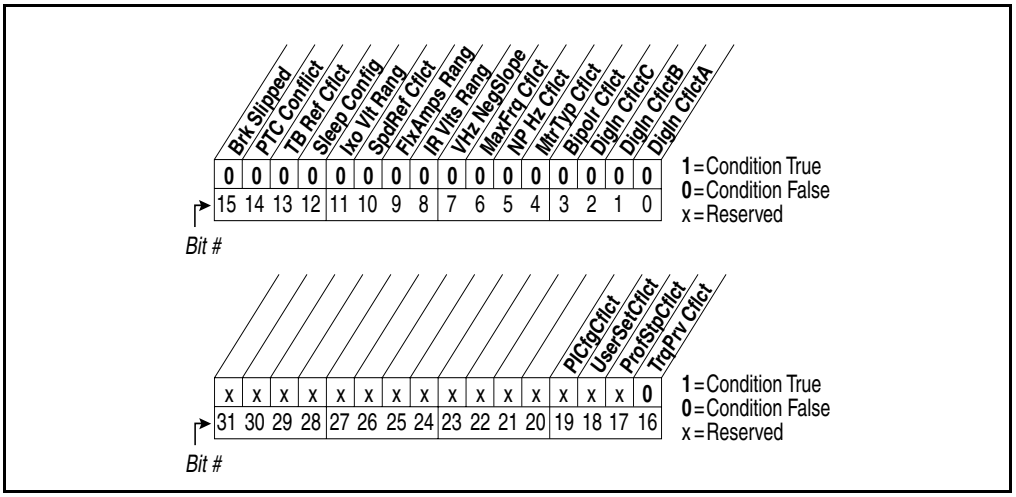

Brk Slipped
PTC Conflict
TB Ref Cflct
Sleep Config
Ixo Vlt Rang
SpdRef Cflct
FlxAmps Rang
IR Vlts Rang
VHz NegSlope
MaxFrq Cflct
NP Hz Cflct
MtrTyp Cflct
BipolrCflct
DiglnCflctC
DiglnCflctB
DiglnCflctA
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Condition True
0 = Condition False
x = Reserved
PlCfgCflct
UserSetCflct
ProfStpCflct
TrqPrv Cflct
x x x x x x x x x x x x x x x 0
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Figure 3.23 – Alarm 2 @ Fault (230)

234 Testpoint 1 Sel

Range: 0 to 65535 [1]

Default: 499

Access: 2 **Path:** Utility>Diagnostics

See also: 235

Selects the function whose value is displayed in Testpoint 1 Data (235). These are internal values that are not accessible through parameters.

See Testpoint Codes and Functions in chapter 4 for a list of codes and functions.

235 Testpoint 1 Data

Range: -/+ 2147483648 [1]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 234

The present value of the function selected in Testpoint 1 Sel (234).

236 Testpoint 2 Sel

Range: 0 to 65535 [1]

Default: 499

Access: 2 **Path:** Utility>Diagnostics

See also: 237

Selects the function whose value is displayed in Testpoint 2 Data (237). These are internal values that are not accessible through parameters.

See the Testpoint Codes and Functions in chapter 4 for a list of codes and functions.

237 Testpoint 2 Data

Range: -/+ 2147483648 [1]

Default: Read Only

Access: 2 **Path:** Utility>Diagnostics

See also: 236

The present value of the function selected in Testpoint 2 Sel (236).

238 Fault Config 1

Range: See figure 3.24

Default: See figure 3.24

Access: 2 **Path:** Utility>Faults

See also:

Enables/disables annunciation of the faults shown in figure 3.24.

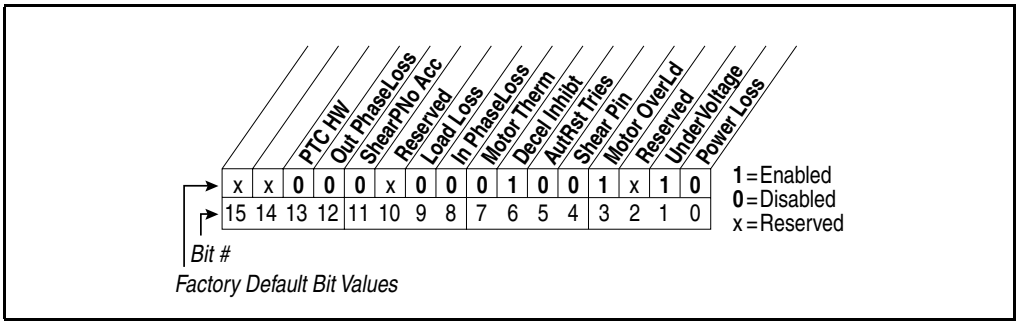


Figure 3.24 – Fault Config 1 (238)

240 Fault Clear

Range: 0 = Ready
1 = Clear Faults
2 = Clr Flt Que

Default: 0 = Ready

Access: 2 **Path:** Utility>Faults

See also:

Resets a fault and clears the fault queue.

241 Fault Clear Mode

Range: 0 = Disabled
1 = Enabled

Default: 1 = Enabled

Access: 2 **Path:** Utility>Faults

See also:

Enables/disables a fault reset (clear faults) attempt from any source. This does not apply to fault codes, which are cleared indirectly via other actions.

242 Power Up Marker

Range: 0.0000 to 214748.3647 Hr [0.0001 Hr]
Default: Read Only
Access: 2 **Path:** Utility>Faults
See also: 244, 246, 248, 250, 252, 254, 256, 258

Elapsed hours since initial drive power up. This value will rollover to 0 after the drive has been powered on for more than the maximum value shown.

243 Fault 1 Code
245 Fault 2 Code
247 Fault 3 Code
249 Fault 4 Code
251 Fault 5 Code
253 Fault 6 Code
255 Fault 7 Code
257 Fault 8 Code

Range: 0000 to 65535
Default: Read Only
Access: 2 **Path:** Utility>Faults
See also:

A code that represents a drive fault. The codes will appear in these parameters in the order they occur. Fault 1 Code = the most recent fault.

244 Fault 1 Time
246 Fault 2 Time
248 Fault 3 Time
250 Fault 4 Time
252 Fault 5 Time
254 Fault 6 Time
256 Fault 7 Time
258 Fault 8 Time

Range: 0.0000 to 214748.3647 [0.0001 Hr]
Default: Read Only
Access: 2 **Path:** Utility>Faults
See also: 242

The time between initial power up and the occurrence of the associated trip fault. Can be compared to Power Up Marker for the time from the most recent power up.

Fault x Time - Power Up Marker = Time difference to the most recent power up. A negative value indicates a fault occurred before the most recent power up. A positive value indicates a fault occurred after the most recent power up.

259 Alarm Config 1

Range: See figure 3.25
Default: See figure 3.25
Access: 2 **Path:** Utility>Alarms
See also:

Enables/disables alarm conditions that will initiate a drive alarm.

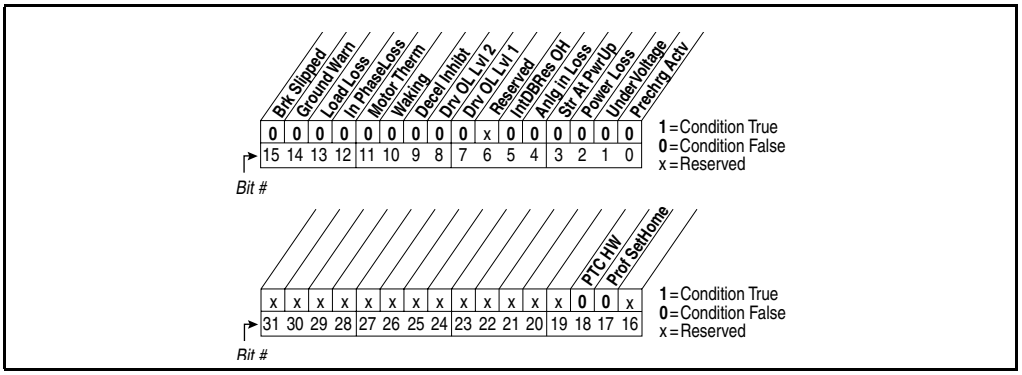

Brk Slipped
Ground Warn
Load Loss
In Phase Loss
Motor Therm
Waking
Decel Inhibit
Drv OL Lvl 2
Drv OL Lvl 1
Reserved
IntDBRes OH
Anlg in Loss
Str At PwrUp
Power Loss
UnderVoltage
Preching Activ
0 0 0 0 0 0 0 0 0 x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Condition True
0 = Condition False
x = Reserved
PTC HW
Prof SetHome
x x x x x x x x x x x x 0 0 x
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16
Rit #
1 = Condition True
0 = Condition False
x = Reserved

Figure 3.25 – Alarm Config 1 (259)

261 Alarm Clear

Range: 0 = Ready
1 = Clr Alarm Que
Default: 0 = Ready
Access: 1 **Path:** Utility>Alarms
See also: 262 - 269

Resets all Alarm1 - 8 Code parameters (262 - 269) to zero.

262 Alarm 1 Code
263 Alarm 2 Code
264 Alarm 3 Code
265 Alarm 4 Code
266 Alarm 5 Code
267 Alarm 6 Code
268 Alarm 7 Code
269 Alarm 8 Code

Range: 0 to 65535 [1]
Default: Read Only
Access: 1 **Path:** Utility>Alarms
See also: 261

A code that represents a drive alarm. The codes will appear in the order that the alarms occur. The first code in is the first out. A time stamp is not available with alarms.

270 DPI Baud Rate

Range: 0 = 125 kbps
1 = 500 kbps

Default: 1 = 500 kbps

Access: 2 **Path:** Communication>Comm Control

See also:

Sets the drive rate for attached drive peripherals. The drive must be reset for the change in value to be effected.

271 Drive Logic Rslt

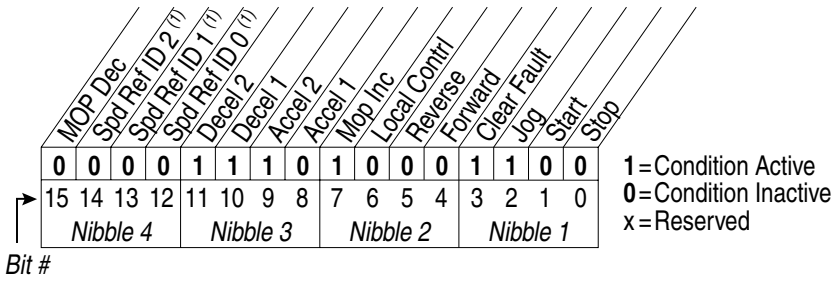
Range: See figure 3.26

Default: Read Only

Access: 2 **Path:** Communication>Comm Control

See also:

The final logic command to the drive resulting from the combination of all port requests and masking functions. Each bit or set of bits represent a command to the drive or follower device.



Bits(1)			Description
14	13	12	
0	0	0	No Command - Man. Mode
0	0	1	Ref A Auto
0	1	0	Preset 2 Auto
0	1	1	Preset 3 Auto
1	0	0	Preset 4 Auto
1	0	1	Preset 5 Auto
1	1	0	Preset 6 Auto
1	1	1	Preset 7 Auto

Figure 3.26 – Drive Logic Rslt (271)

272 Drive Ref Rslt

Range: -/+32767 [1]

Default: Read Only

Access: 2 **Path:** Communication>Comm Control

See also:

Present frequency reference scaled as a DPI reference for peer-to-peer communications. The value shown is the output prior to the accel/decel ramp and any corrections supplied by slip comp, PI, etc.

273 Drive Ramp Rslt

Range: -/+32767 [1]

Default: Read Only

Access: 2 **Path:** Communication>Comm Control

See also:

Present frequency reference scaled as a DPI reference for peer-to-peer communications. The value shown is the value after the accel/decel ramp but prior to any corrections supplied by slip comp, PI, etc.

274 DPI Port Sel

Range: 0 = Not Used
1 = DPI Port 1
2 = DPI Port 2
3 = DPI Port 3
4 = DPI Port 4
5 = DPI Port 5

Default: 0 = Not Used

Access: 2 **Path:** Communication>Comm Control

See also:

Selects which DPI port reference value will appear in DPI Port Value (275).

275 DPI Port Value

Range: -/+32767 [1]

Default: Read Only

Access: 2 **Path:** Communication>Comm Control

See also:

Value of the DPI reference selected in DPI Port Sel (274).

.

276 Logic Mask

Range: See figure 3.27

Default: See figure 3.27

Access: 2 **Path:** Communication>Masks & Owners

See also: 288-297

Determines which ports can control the drive when Write Mask Act (597), bit 15 is set to “1.” If the bit for a port is set to “0,” the port will have no control functions except for stop.

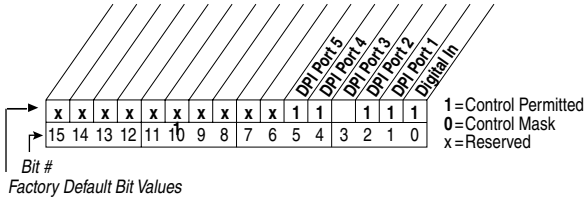

DPI Port 5
DPI Port 4
DPI Port 3
DPI Port 2
DPI Port 1
Digital In
x x x x x x x x x x 1 1 1 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
1 = Control Permitted
0 = Control Mask
x = Reserved
Bit #
Factory Default Bit Values

Figure 3.27 – Logic Mask (276)

277 Start Mask

Range: See figure 3.27

Default: See figure 3.27

Access: 2 **Path:** Communication>Masks & Owners

See also: 288-297

Controls which adapters can issue start commands.

278 Jog Mask

Range: See figure 3.27

Default: See figure 3.27

Access: 2 **Path:** Communication>Masks & Owners

See also: 288-297

Controls which adapters can issue jog commands.

279 Direction Mask

Range: See figure 3.27

Default: See figure 3.27
Access: 2 **Path:** Communication>Masks & Owners
See also: 288-297

Controls which adapters can issue forward/reverse direction commands.

280 Reference Mask

Range: See figure 3.27

Default: See figure 3.27
Access: 2 **Path:** Communication>Masks & Owners
See also: 288-297

Controls which adapters can select an alternate reference.

281 Accel Mask

Range: See figure 3.27

Default: See figure 3.27
Access: 2 **Path:** Communication>Masks & Owners
See also: 288-297

Controls which adapters can select Accel Time 1 (140) and Accel Time 2 (141).

282 Decel Mask

Range: See figure 3.27

Default: See figure 3.27
Access: 2 **Path:** Communication>Masks & Owners
See also: 288-297

Controls which adapters can select Decel Time 1 (142) and Decel Time 2 (143).

283 Fault Clr Mask

Range: See figure 3.27

Default: See figure 3.27
Access: 2 **Path:** Communication>Masks & Owners
See also: 288-297

Controls which adapters can clear a fault.

284 MOP Mask

Range: See figure 3.27

Default: See figure 3.27

Access: 2 **Path:** Communication>Masks & Owners

See also: 288-297

Controls which adapters can issue MOP commands to the drive.

285 Local Mask

Range: See figure 3.27

Default: See figure 3.27

Access: 2 **Path:** Communication>Masks & Owners

See also: 288-297

Controls which adapters are allowed to take exclusive control of drive logic commands (except stop). Exclusive “local” control can only be taken while the drive is stopped.

286 Manual Mask

Range: See figure 3.28

Default: See figure 3.28

Access: 2 **Path:** Communication>Masks & Owners

See also:

Disables manual requests at the port corresponding to bit number.

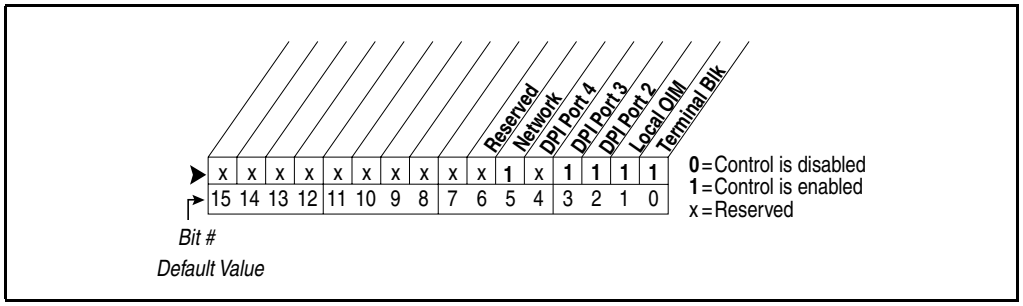

Reserved
Network
DPI Port 4
DPI Port 3
DPI Port 2
Local OIM
Terminal Blk
x x x x x x x x x x 1 x 1 1 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Default Value
0 = Control is disabled
1 = Control is enabled
x = Reserved

Figure 3.28 – Manual Mask (286)

287 Manual Owner

Range: See figure 3.29

Default: See figure 3.29

Access: 2 **Path:** Communication>Masks & Owners

See also:

Indicates the source providing manual control.

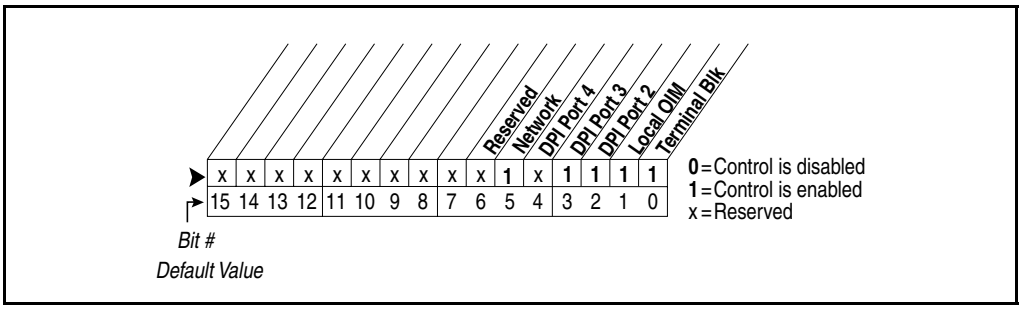

Reserved
Network
DPI Port 4
DPI Port 3
DPI Port 2
Local OIM
Terminal Blk
x x x x x x x x x x 1 x 1 1 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Default Value
0 = Control is disabled
1 = Control is enabled
x = Reserved

Figure 3.29 – Manual Owner (287)

288 Stop Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Modules that are presently issuing a valid stop command.

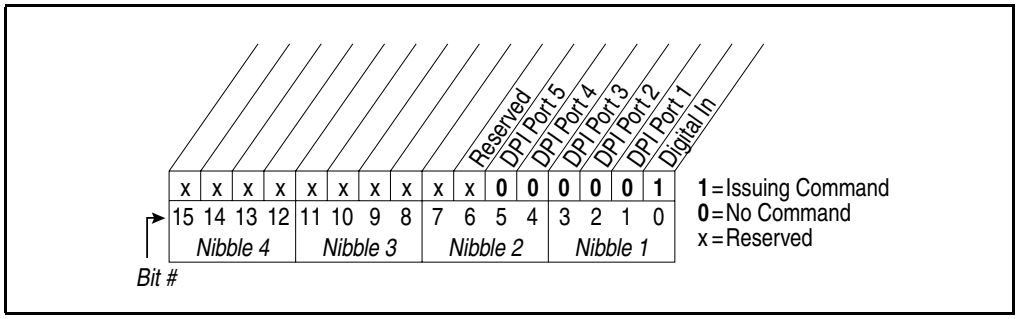

Reserved
DPI Port 5
DPI Port 4
DPI Port 3
DPI Port 2
DPI Port 1
Digital In
x x x x x x x x x x 0 0 0 0 0 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Issuing Command
0 = No Command
x = Reserved

Figure 3.30 – Stop Owner

289 Start Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapters that are presently issuing a valid start command.

290 Jog Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapters that are presently issuing a valid job command.

291 Direction Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapter that currently has exclusive control of direction changes.

292 Reference Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapter that has the exclusive control of the command frequency source selection.

293 Accel Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapter that has exclusive control of selecting Accel Time 1 (140) and Accel Time 2 (141).

294 Decel Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapter that has exclusive control of selecting Decel Time 1 (142) and Decel Time 2 (143).

295 Fault Clr Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapter that is presently clearing a fault.

296 MOP Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapters that are currently issuing increases or decreases in MOP command frequency.

297 Local Owner

Range: See figure 3.30
Default: Read Only
Access: 2 **Path:** Communication>Masks & Owners
See also: 276 - 285

Adapter that has requested exclusive control of all drive logic functions. If an adapter is in local lockout, all other functions (except stop) on all other adapters are locked out and non-functional. Local control can only be obtained when the drive is not running.

298 DPI Ref Scale

Range: 0 = Max Freq
1 = Max Speed
Default: 0 = Max Freq
Access: 2 **Path:** Communication>Comm Control
See also:

Scales DPI on maximum frequency or maximum speed.

299 DPI Fdbk Select

Range: 0 = Output Freq
1 = Command Spd
2 = Output Amps
3 = Torque Amps
4 = Flux Amps
5 = Output Power
6 = Output Volts
7 = DC Bus Volts
8 = PI Reference
9 = PI Feedback
10 = PI Error
11 = PI Output
12 = %Motor OL
13 = %Drive OL
14 = CommandedTrq
15 = MtrTrqCurRef
16 = Speed Ref
17 = Speed Fdbk
18 = Pulse In Ref
19 = Reserved
20 = Scale Block 1
21 = Scale Block 2
22 = Scale Block 3
23 = Scale Block 4
24 = Param Cntl
25 = SpdFb NoFilt

Default: 17 = Speed Fdbk

Access: 2 **Path:** Communication>Comm Control

See also:

Selects the data to be copied into the DPI feedback data register.

300 Data In A1 - Link A Word 1
301 Data In A2 - Link A Word 2

Range: 0 to 611 [1]

Default: 0 (Disabled)

Access: 2 **Path:** Communication>Datalinks

See also:

Parameter number whose value will be written from a communications device data table.

Standard Control = Parameters that can be changed only while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will disable the link

Vector Control = Will not be updated until drive is stopped.

Refer to the appropriate communications option board manual for datalink information.

302 **Data In B1** - Link B Word 1
303 **Data In B2** - Link B Word 2

Range: 0 to 611 [1]
Default: 0 (Disabled)
Access: 2 **Path:** Communication>Datalinks
See also:

Parameter number whose value will be written from a communications device data table.

Standard Control = Parameters that can be changed only while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will disable the link

Vector Control = Will not be updated until drive is stopped.

Refer to the appropriate communications option board manual for datalink information.

304 **Data In C1** - Link C Word 1
305 **Data In C2** - Link C Word 2

Range: 0 to 611 [1]
Default: 0 (Disabled)
Access: 2 **Path:** Communication>Datalinks
See also:

Parameter number whose value will be written from a communications device data table.

Standard Control = Parameters that can be changed only while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will disable the link

Vector Control = Will not be updated until drive is stopped.

Refer to the appropriate communications option board manual for datalink information.

306 **Data In D1** - Link D Word 1
307 **Data In D2** - Link D Word 2

Range: 0 to 611 [1]
Default: 0 (Disabled)
Access: 2 **Path:** Communication>Datalinks
See also:

Parameter number whose value will be written from a communications device data table.

Standard Control = Parameters that can be changed only while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will disable the link

Vector Control = Will not be updated until drive is stopped.

Refer to the appropriate communications option board manual for datalink information.

310 Data Out A1- Link A Word 1
311 Data Out A2 - Link A Word 2

Range: 0 to 611 [1]

Default: 0 (Disabled)

Access: 2 **Path:** Communication>Datalinks

See also:

Parameter number whose value will be written to a communications device data table.

312 Data Out B1- Link B Word 1
313 Data Out B2 - Link B Word 2

Range: 0 to 611 [1]

Default: 0 (Disabled)

Access: 2 **Path:** Communication>Datalinks

See also:

Parameter number whose value will be written to a communications device data table.

314 Data Out C1- Link C Word 1
315 Data Out C2 - Link C Word 2

Range: 0 to 611 [1]

Default: 0 (Disabled)

Access: 2 **Path:** Communication>Datalinks

See also:

Parameter number whose value will be written to a communications device data table.

316 Data Out D1- Link D Word 1
317 Data Out D2 - Link D Word 2

Range: 0 to 611 [1]

Default: 0 (Disabled)

Access: 2 **Path:** Communication>Datalinks

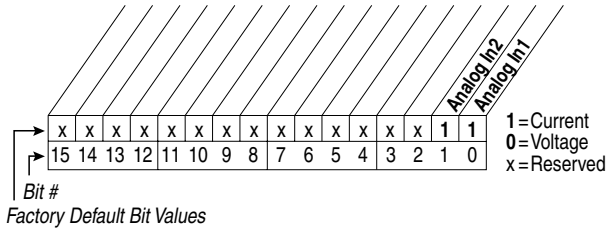
See also:

Parameter number whose value will be written to a communications device data table.

320 Anlg In Config

Range: See figure 3.31
Default: See figure 3.31
Access: 0 **Path:** Inputs & Outputs>Analog Inputs
See also: 322, 323, 325, 326

Selects the type of input signal being used for analog input 1 and 2. These inputs can be configured as 10VDC (unipolar or bipolar) or as 4-20mA inputs. See scaling parameters Analog In 1 (322 and 323) and Analog In 2 (325 and 326).


Analog In2
Analog In1
x x x x x x x x x x x x x 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
1 = Current
0 = Voltage
x = Reserved
Bit #
Factory Default Bit Values

Analog In 1	Bit	Term
0 to 10 VDC or -10 to +10 VDC	Bit 0 = 0	1, 2 (17 to 18 not jumpered)
4 to 20 mA	Bit 0 = 1	1, 2 (17 to 18 jumpered)
Analog In 2	**Bit**	**Term**
-0 to 10 VDC or -10 to +10 VDC	Bit 1 = 0	3, 4 (19 to 20 not jumpered)
4 to 20 mA	Bit 1 = 1	3, 4 (19 to 20 jumpered)

Figure 3.31 – Anlg In Config (320)

321 Anlg In Sqr Root

Range: See figure 3.32
Default: See figure 3.32
Access: 2 **Path:** Inputs & Outputs>Analog Inputs
See also:

Enables/disables the square root function for each analog input.

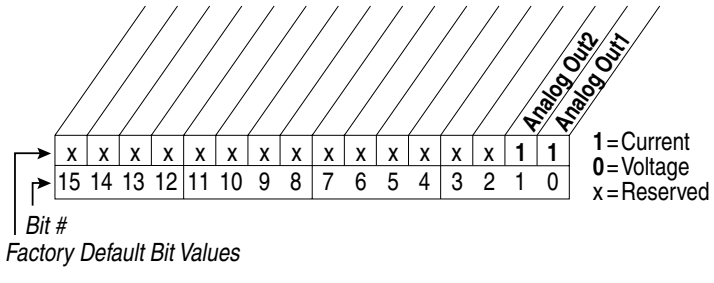

Analog Out2
Analog Out1
x x x x x x x x x x x x x 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
1 = Current
0 = Voltage
x = Reserved
Bit #
Factory Default Bit Values

Figure 3.32 – Anlg in Sqr Root (321)

322 Analog In 1 Hi

Range:	0.000 to 20.000 mA [0.001 mA] -/+10.000 V [0.001 V] 0.0 to 10.000 V [0.001 V]
Default:	20.000 mA
Access:	0 **Path:** Inputs & Outputs>Analog Inputs
See also:	91, 92

Analog In 1 Hi sets the highest input value to the analog input 1 scaling block.

Anlg In Config (320) defines if the input value will be -/+10V or 0-20 mA.

Analog Input Scaling Example

Assume:

Speed Ref A Sel = Analog In 1

Minimum Freq = 0 Hz

Maximum Freq = 60 Hz

Analog In 1 Lo = 0.0 V

Analog In 1 Hi = 10.0 V

This is the default setting, where minimum input (0 V) represents Minimum Speed and maximum input (10 V) represents Maximum Speed.

323 Analog In 1 Lo

Range:	0.000 to 20.000 mA [0.001 mA] -/+10.000 V [0.001 V] 0.0 to 10.000 V [0.001 V]
Default:	4.000 mA
Access:	0 **Path:** Inputs & Outputs>Analog Inputs
See also:	91, 92

Sets the lowest input value to the analog input 1 scaling block.

Anlg In Config (320) defines if the input value will be -/+10V or 0-20 mA.

If set below 4 mA, Analog In x Loss (324) should be “Disabled.”

324 Analog In 1 Loss

Range:	0 = Disabled 1 = Fault 2 = Hold Input (use last frequency command) 3 = Set Input Lo (use Minimum Speed as frequency command) 4 = Set Input Hi (use Maximum Speed as frequency command) 5 = Go to Preset1 (use Preset 1 as frequency command) 6 = Hold OutFreq (maintain last output frequency)
Default:	0 = Disabled
Access:	2 **Path:** Inputs & Outputs>Analog Inputs
See also:	91, 92, 190

Selects drive response when an analog signal loss is detected. Signal loss is defined as an analog signal less than 1 V or 2 mA. The signal loss event ends and normal operation resumes when the input signal level meets or exceeds 1.5 V or 3 mA.

One of the selections (1=Fault) stops the drive on signal loss. All other choices make it possible for the input signal to return to a usable level while the drive is still running.

ATTENTION: Setting parameter 324 to a value greater than 1 allows the input signal to return to a usable level while the drive is running. If a lost analog signal is restored while the drive is running, the drive will ramp to the restored reference level at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142), and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

325 Analog In 2 Hi

Range:	4.000 to 20.000 mA [0.001 mA] -/+10.000 V [0.001 V]; 0.0 to 10.000 V [0.001 V]
Default:	10.000 V
Access:	2 **Path:** Inputs & Outputs>Analog Inputs
See also:	91, 92

Analog In 2 Hi sets the highest input value to the analog input 2 scaling block.

Anlg In Config (320) defines if the input value will be -/+10V or 0-20 mA.

326 Analog In 2 Lo

Range:	4.000 to 20.000 mA [0.001 mA] -/+10.000 V [0.001 V]; 0.0 to 10.000 V [0.001 V]
Default:	0.000 V
Access:	2 **Path:** Inputs & Outputs>Analog Inputs
See also:	91, 92

Sets the lowest input value to the analog input 2 scaling block.

Anlg In Config (320) defines if the input value will be -/+10V or 0-20 mA.

If set below 4 mA, Analog In x Loss (324) should be “Disabled.”

327 Analog In 2 Loss

Range: 0 = Disabled
1 = Fault
2 = Hold Input (use last frequency command)
3 = Set Input Lo (use Minimum Speed as frequency command)
4 = Set Input Hi (use Maximum Speed as frequency command)
5 = Go to Preset1 (use Preset1 as frequency command)
6 = Hold OutFreq (maintain last output frequency)

Default: 0 = Disabled

Access: 2 **Path:** Inputs & Outputs>Analog Inputs

See also: 91, 92

Selects drive response when an analog signal loss is detected. Signal loss is defined as an analog signal less than 1 V or 2 mA. The signal loss event ends and normal operation resumes when the input signal level meets or exceeds 1.5 V or 3 mA.

One of the selections (1=Fault) stops the drive on signal loss. All other choices make it possible for the input signal to return to a usable level while the drive is still running.

ATTENTION: Setting parameter 327 to a value greater than 1 allows the input signal to return to a usable level while the drive is running. If a lost analog signal is restored while the drive is running, the drive will ramp to the restored reference level at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142), and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

340 Analog Out Config

Range: See figure 3.33

Default: See figure 3.33

Access: 0 **Path:** Inputs & Outputs>Analog Outputs

See also:

Selects the mode for analog outputs.

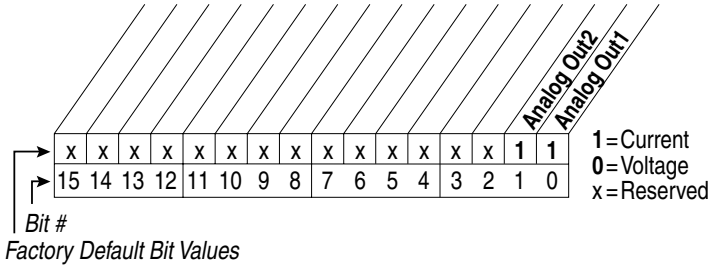

Analog Out2
Analog Out1
x x x x x x x x x x x x x x 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values
1 = Current
0 = Voltage
x = Reserved

Figure 3.33 – Analog Out Config

341 Anlg Out Absolut

Range: See figure 3.34

Default: See figure 3.34

Access: 2 **Path:** Inputs & Outputs>Analog Outputs

See also:

Selects whether the signed value or absolute value of a parameter is used before being scaled to drive the analog output.

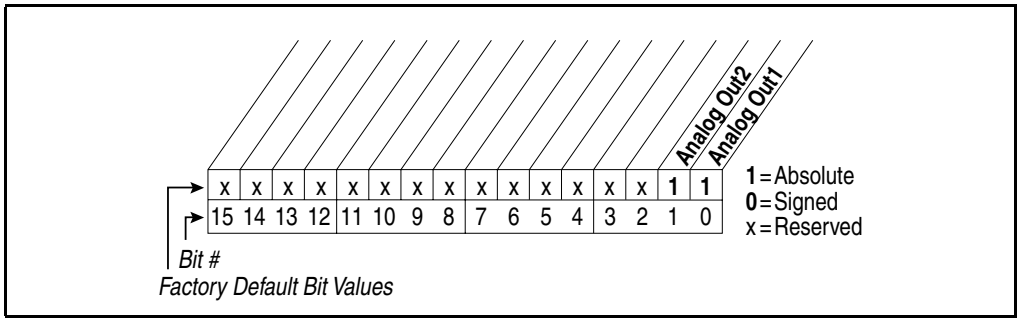

Analog Out2
Analog Out1
x x x x x x x x x x x x x x 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values
1 = Absolute
0 = Signed
x = Reserved

Figure 3.34 – Anlg Out Absolute (341)

342 Analog Out1Sel
345 Analog Out2 Sel

Range:
0 = Output Freq
1 = Command Freq
2 = Output Amps
3 = Torque Amps
4 = Flux Amps
5 = Output Power
6 = Output Volts
7 = DC Bus Volts
8 = PI Reference
9 = PI Feedback
10 = PI Error
11 = PI Output
12 = %Motor OL
13 = %Drive OL
14 = CommandedTrq
15 = MtrTqrCurRef
16 = Speed Ref
17 = Speed Fdbk
18 = Pulse In Ref
19 = Torque Est
20 = Scale Block 1
21 = Scale Block 2
22 = Scale Block 3
23 = Scale Block 4
24 = Param Cntl
25 = SpdFb NoFilt

Default: 0 = Output Freq

Access: 1 **Path:** Inputs & Outputs>Analog Outputs

See also: 1 - 7, 12, 135 - 138, 219, 220

Selects the source of the value that drives the analog output.

Table 3.3 – Analog Out1/2 Sel

Options	Analog Out1/2 Lo Value		Analog Out1/2 Hi
	P.341 = Signed	P.341 = Absolute	
0 = Output Freq	-Maximum Speed	0 Hz	+ Maximum Speed
1 = Command Spd	-Maximum Speed	0 Hz/RPM	+ Maximum Speed
2 = Output Amps	0 Amps	0 Amps	200% Rated
3 = Torque Amps	-200% Rated	0 Amps	200% Rated
4 = Flux Amps	0 Amps	0 Amps	200% Rated
5 = Output Power	0 kW	0 kW	200% Rated
6 = Output Volts	0 Volts	0 Volts	120% Rated Input Volts
7 = DC Bus Volts	0 Volts	0 Volts	200% Rated Input Volts
8 = PI Reference	-100%	0%	100%
9 = PI Feedback	-100%	0%	100%
10 = PI Error	-100%	0%	100%
11 = PI Output	-100%	0%	100%
12 = %Motor OL	0%	0%	100%
13 = %Drive OL	0%	0%	100%
14 = CommandedTrq	-800% Rated	0%	800% Rated
15 = MtrTrqCurRef	-200% Rated	0%	200% Rated
16 = Speed Ref	-Maximum Speed	0 Hz/RPM	+ Maximum Speed
17 = Speed Fdbk	-Maximum Speed	0 Hz/RPM	+ Maximum Speed
18 = Pulse In Ref	-25200.0 RPM	0 Hz/RPM	+ Maximum Speed
19 = Torque Est	-800%	0%	800%
20 = Scale Block 1	0%	0%	100%
21 = Scale Block 2	0%	0%	100%
22 = Scale Block 3	0%	0%	100%
23 = Scale Block 4	0%	0%	100%
24 = Param Cntl	0%	0%	100%
25 = SpdFb NoFilt	0%	0%	100%

343 Analog Out1 Hi
346 Analog Out2 Hi

Range: 0.000 to 20.000 mA or -/+10.000 V [0.001 mA or 0.001 V]

Default: 20.000 mA or 10.000 V

Access: 1 **Path:** Inputs & Outputs>Analog Outputs

See also: 340, 342

Sets the analog output value when the source value is at maximum.

344 Analog Out1 Lo
347 Analog Out2 Lo

Range: 0.000 to 20.000 mA or -/+10.000 V [0.001 mA or 0.001 V]

Default: 0.000 mA or 0.000 V

Access: 1 **Path:** Inputs & Outputs>Analog Outputs

See also: 340, 342

Sets the analog output value when the source value is at minimum.

354 Analog Out1 Scale
355 Analog Out2 Scale

Range: Analog Out1Sel [0.01]

Default: 0.0 (Disable)

Access: 2 **Path:** Inputs & Outputs>Analog Outputs

See also: 340, 342

Sets the high value for the range of analog out scale.

Entering 0.0 will disable this scale and max scale will be used.

Example: If Analog Outx Sel (342,345) = Commanded Trq, then a value of 150 = 150% scale in place of the default 800%.

361 Digital In1 Sel
362 Digital In2 Sel
363 Digital In3 Sel
364 Digital In4 Sel
365 Digital In5 Sel
366 Digital In6 Sel

Range:
0 = Not Used
1 = Enable
2 = Clear Faults[1]
3 = Function Loss
4 = Stop-CF
5 = Start[2]
6 = Fwd/Reverse[2]
7 = Run
8 = Run Forward[3]
9 = Run Reverse[3]
10 = Jog1[2]
11 = Jog Forward[3]
12 = Jog Reverse [3]
13 = Stop Mode B
14 = Bus Reg Md B
15 = Speed Sel 1
16 = Speed Sel 2
17 = Speed Sel 3
18 = Auto/Manual
19 = Reserved
20 = Acc2 & Dec2
21 = Accel 2
22 = Decel 2
23 = MOP Inc
24 = MOP Dec
25 = HIM Control
26 = PI Enable
27 = PI Hold
28 = PI Reset
29 = Pwr Loss Lvl
30 = Precharge En
31 = Spd/Trq Sel1
32 = Spd/Trq Sel2
33 = Spd/Trq Sel3
34 = Jog2
35 = PI Invert
36 = Torque Setpt1
37 = Micro Pos
38 = Fast Stop
39 = Decel Limit
40 = End Limit
41 = UserSet Sel1
42 = UserSet Sel2
43 = Run Level
44 = RunFwd Level
45 = RunRev Level
46 = Run w/Comm
47 = Hold Step

361 Digital In1 Sel
362 Digital In2 Sel
363 Digital In3 Sel
364 Digital In4 Sel
365 Digital In5 Sel
366 Digital In6 Sel

	48 =Set Home 49 = Find Home 50 = Home Limit 51 = Vel Override 52 = Pos Sel 1 53 = Pos Sel 2 54 = Pos Sel 3 55 = Pos Sel 4 56 = Pos Sel 5 57 = Prof Input
Default:	See table 11.6
Access:	361= 0 **Path:** Inputs & Outputs>Digital Inputs 362-366 = 1
See also:	96, 100, 124, 140, 156, 162, 194, 380

[1] When Digital Inx Sel is set to 2 = Clear Faults, the Stop button cannot be used to clear a fault condition.

[2] Typical 3-wire Inputs: Only 3-wire functions are allowed. Including 2-wire selections will cause a type 2 alarm.

[3] Typical 2-wire Inputs: Only 2-wire functions are allowed. Including 3-wire selections will cause a type 2 alarm.

Assigns an input function to the drive's digital inputs.

Table 3.4 – Speed Select Inputs

Speed Select Inputs (17,16,15)			
3	**2**	**1**	**Reference Source**
0	0	0	Reference A
0	0	1	Reference B
0	1	0	Preset Speed 2
0	1	1	Preset Speed 3
1	0	0	Preset Speed 4
1	0	1	Preset Speed 5
1	1	0	Preset Speed 6
1	1	1	Preset Speed 7

To access Preset Speed 1, set Speed Ref x Sel to Preset Speed 1.

Table 3.5 – Spd/Trq Sel # Inputs

Speed/Torque Select Inputs (33, 32, 31)			
3	**2**	**1**	**Reference Source**
0	0	0	Zero Torque
0	0	1	Speed Regulator
0	1	0	Torque Regulator
0	1	1	Min Speed/Torque
1	0	0	Max Speed/Torque
1	0	1	Sum Speed/Torque
1	1	0	Absolute
1	1	1	Zero Torque

Table 3.6 – Default Values for Parameters 361-366

Parameter No.	Default Value
361	4 = Stop-CF
362	5 = Start
363	3 = Function Loss
364	10 = Jog
365	18 = Auto/Manual
366	15 = Speed Sel 1

The input functions are:

1 = Enable: If the input is closed, the drive can run (start permissive). If the input is open, the drive will not start.

If the drive is already running when this input is opened, the drive will coast and indicate “not enabled” on the HIM (if present). This is not considered a fault condition, and no fault will be generated.

If multiple enable inputs are configured, the drive will not run if any of them are open.

2 = Clear Faults: This function allows an external device to reset drive faults through the terminal block if Logic Source Sel (89) is set to Terminal Blk or All Ports. An open-to-closed transition on this input will reset the current fault (if any).

If this input is configured at the same time as Stop-Clear Faults, then only the Clear Faults input can actually cause faults to be reset.

3 = Aux Fault: If the function loss input is open, a fault is generated. The function loss input is active at all times regardless of the selected logic control source.

Important: The function loss input is not intended for a fast output power kill. The drive will not fault until the software detects the change of state of this input. If this input function is not configured, the fault will not occur.

4 = Stop - CF (Stop - Clear Faults): An open input will always assert a stop command. While the stop is asserted, the drive ready status will be off. A closed input will allow the drive to start. An open-to-closed transition is interpreted as a clear faults request. The drive will clear any existing faults.

If Start is configured, then Stop-Clear Faults must also be configured to prevent a digital input configuration alarm condition. Stop-Clear Faults is optional in all other circumstances.

5 = Start: An open-to-closed transition generates a run command if the terminal block is the control source.

If Start is configured, then Stop-Clear Faults must also be configured to prevent a digital input configuration alarm condition.

6 = Fwd/Reverse (Forward/Reverse): An open input sets the direction to forward if the terminal block is the control source. A closed input sets the direction to reverse. If the state of the input changes and the drive is running or jogging, the drive will change direction.

If the Fwd/Rev input function is assigned to more than one physical digital input at a time, a digital input configuration alarm will be asserted.

7 = Run: An open-to-closed transition on this input generates a a run command if the terminal block is the control source. If the input is open, the drive will stop.

The purpose of this input function is to allow a 2-wire start while the direction is being controlled by some other function.

8 and **9 = Run Forward** and **Run Reverse:** If the terminal block is the control source, an open-to-closed transition on one or both inputs while the drive is stopped will cause the drive to run unless the Stop - Clear Faults input function is configured and open.

If one or both of these input functions are assigned to more than one physical digital input at a time, a digital input configuration alarm will be asserted.

10 and **34 = Jog:** An open-to-closed transition on this input while the drive is stopped causes the drive to start (jog) in the current direction. When the input opens while the drive is running (jogging), the drive will stop.

ATTENTION: If a normal drive start command is received while the drive is jogging, the drive will switch from jog mode to run mode. The drive will not stop, but may change speed and/or change direction. Failure to observe this precaution could result in severe bodily injury or loss of life.

The drive will not jog while running or while the Stop - Clear Faults input is open. Start has precedence over jog.

11 and **12** = **Jog Forward** and **Jog Reverse:** An open-to-closed transition on one or both inputs while the drive is stopped will cause the drive to jog unless the Stop - Clear Faults input function is configured and open. Table 3.7 on page 94 describes the actions taken by the drive in response to various states of these input functions.

Table 3.7 – Drive Response to Jog Forward and Jog Reverse Inputs

Jog Forward	Jog Reverse	Drive Response
Open	Open	Drive will stop if already jogging, but can be started by other means.
Open	Closed	Drive jogs in reverse direction.
Closed	Open	Drive jogs in forward direction.
Closed	Closed	Drive continues to jog in current direction.

ATTENTION: If a normal drive start command is received while the drive is jogging, the drive will switch from jog mode to run mode. The drive will not stop, but may change speed and/or change direction. Failure to observe this precaution could result in severe bodily injury or loss of life.

The drive will not jog while running or while the Stop-Clear Faults input is open. Start has precedence over jog.

If one of these input functions is configured and the other one is not, table 3.7 still applies, but the unconfigured input function should be considered permanently open.

13 = Stop Mode B: This digital input selects between two different drive stop modes.

If the input is open, then Stop Mode A selects which stop mode to use. If the input is closed, the Stop Mode B selects which stop mode to use. If this input function is not configured, then Stop Mode A selects which stop mode to use.

14 = Bus Regulation Mode B: This digital input function selects how the drive will regulate excess voltage on the DC bus.

If the input is open, then Bus Reg Mode A selects which bus regulation mode to use. If the input is closed, then Bus Reg Mode B selects which bus regulation mode to use. If this input function is not configured, then Bus Reg Mode A selects which bus regulation mode to use.

15-17 = Speed Select 1, 2, 3: One, two, or three digital input functions can be used to select the speed reference used by the drive, and they are called the Speed Select input functions. The current open/closed state of all Speed Select input functions combine to select which source is the current speed reference.

There are 7 possible combinations of open/closed states for the three input functions, and thus 7 possible parameters can be selected. The 7 parameters are: Speed Ref A Sel and Preset Speed 2 through Preset Speed 7.

If the Speed Select input functions select Speed Ref A Sel, then the value of that parameter further selects a reference source. There are a large number of possible selections, including all 6 presets.

If the input functions directly select one of the preset speed parameters, then the parameter contains a frequency that is to be used as the reference.

The Speed Select input function configuration process involves assigning the functionality of the three possible Speed Select input functions to physical digital inputs. The three Speed Select inputs functions are called Speed Select 1, Speed Select 2, and Speed Select 3, and they are assigned to physical inputs using the Digital In"x" Sel parameters.

Table 10.6 describes the various reference sources that can be selected using all three of the Speed Select input functions. If any of the three Reference Select input functions are not configured, then the software will still follow the table, but will treat the unconfigured inputs as if they are permanently open.

Table 3.8 – Effect of Speed Select Input State on Selected Reference

Speed Select 3	Speed Select 2	Speed Select 1	Parameter that determines reference:
Open	Open	Open	Speed Ref A Sel
Open	Closed	Open	Preset Speed 2
Open	Closed	Closed	Preset Speed 3
Closed	Open	Open	Preset Speed 4
Closed	Open	Closed	Preset Speed 5
Closed	Closed	Open	Preset Speed 6
Closed	Closed	Closed	Preset Speed 7

18 = Auto/Manual: The Auto/Manual function allows a single control device to assume exclusive control of reference select. The most recent peripheral (HIM or terminal block) that makes a manual reference request will be given control of the reference.

If the Auto/Manual input function is closed, then the drive will use one of the analog inputs (defined by TB Man Ref Sel (96)) as the reference. If an HIM subsequently requests manual control (that is, Auto/Man F-Key is pressed) and then gives control up (presses Auto/Man F-Key again), then the Auto/Manual digital input must be opened and closed again to regain control of the manual reference.

If this input is open, then the terminal block does not request manual control of the reference. If no control device (including the terminal block) is current requesting manual control of the reference, then the drive will use the normal reference selection mechanisms.

20 = Acc2 & Dec2: A single input function is used to select between Accel Time 1/Decel Time 1 and Accel Time 2/Decel Time2.

If the function is open, the drive will use Accel Time 1 as the acceleration rate and Decel Time 1 as the deceleration rate. If the function is closed, the drive will use Accel Time 2 as the acceleration rate and Decel Time 2 as the deceleration rate.

21, 22 = Accel 2, Decel 2: One input function (called Accel 2) selects between Accel Time 1 and Accel Time 2, and another input function (called Decel 2) selects between Decel Time 1 and Decel Time 2. The open state of the function selects Accel Time 1 or Decel Time 1, and the closed state selects Accel Time 2 or Decel Time 2.

23, 24 = MOP Increment, MOP Decrement: The MOP is a reference setpoint (called the MOP Value) that can be incremented and decremented by external devices. These inputs are used to increment and decrement the Motor Operated Potentiometer (MOP) value inside the drive. The MOP value will be retained through a power cycle.

While the MOP Increment input is closed, the MOP value will increase at rate contained in MOP Rate. Units for rate are Hz per second.

While the MOP Decrement input is closed, MOP value will decrease at rate contained in MOP Rate. Units for rate are Hz per second.

If both the MOP Increment and MOP Decrement inputs are closed, the MOP value will stay the same.

In order for the drive to use the MOP value as the current speed reference, either Speed Ref A Sel must be set to MOP.

25 = HIM Control: This input provides a mean to override the logic control source selection and can be used to override control from any port, including the All Ports selection.

An open-to-closed transition of this input sets the control source to the local HIM. If no local HIM is present, the control source is set to the remote HIM. If no HIM is present at all, the drive stops.

When control is set to the HIM, the HIM is granted manual reference (the Man Ref Preload (193) configuration is enforced). Subsequent Auto/Manual commands will toggle the HIM in and out of manual mode. The drive's active or stopped state is not affected unless no HIM is present.

On a closed-to-open transition, manual control is released if active, and the selected auto reference is used. The logic source select override is removed. The edge/level-sense start configuration is imposed (LevelSense Start).

26 = PI Enable: If this input function is closed, the operation of the Process PI loop will be enabled.

If this input function is open, the operation of the Process PI loop will be disabled. See PI Control (125), bit 0.

27 = PI Hold: If this input function is closed, the integrator for the Process PI loop will be held at the current value; that is, it will not increase.

If this input function is open, the integrator for the Process PI loop will be allowed to increase.

28 = PI Reset: If this input function is closed, the integrator for the Process PI loop will be reset to 0.

If this input function is open, the integrator for the Process PI loop will integrate normally.

29 = Pwr Loss Lvl: When the DC bus level in the drive falls below a certain level, a "powerloss" condition is created in the drive logic. This input allows the user to select between two different "power loss" detection levels dynamically. If the physical input is closed, then the drive will take its power loss level from a parameter. If the physical input is open (de-energized), then the drive will use a power loss level designated by internal drive memory, typically 82% of nominal. If the input function is not configured, then the drive always uses the internal power loss level.

30 = Precharge En: This input function is used to manage disconnection from a common DC bus.

If the physical input is closed, this indicates that the drive is connected to common DC bus and normal precharge handling can occur, and that the drive can run (start permissive). If the physical input is open, this indicates that the drive is disconnected from the common DC bus, and thus the drive should enter the precharge state (precharge relay open) and initiate a coast stop immediately in order to prepare for reconnection to the bus.

If this input function is not configured, then the drive assumes that it is always connected to the DC bus, and no special precharge handling will be done.

31-33 = Spd/Trq Sel#: See Table 11.5.

35 = PI Invert: Inverts the sign of the PI Error Value.

36 = Torque Setpt1: Selects Torque Setpt1 for Torque Ref A Sel when set. If Torque Setpt1 is not set, the value selected in Torque Ref A Sel is used.

37 = Micro Pos: Microposition Input. When closed, command frequency is set to a percentage speed reference as defined in MicroPosScale% (611).

38 = Fast Stop: When closed, drive will stop with a 0.1 second decel time. If Torque Proving is in use, float will be ignored at end of ramp and the mechanical brake will be set.

39 = Decel Limit: Reference changed to preset speed 1 when activated.

40 = End Limit: Enables a fast stop to zero speed using a zero decel time.

41-42 = UserSet Sel#: 0 = Disabled; 1 = Enabled

43-45 = Run Level, RunFwd Level, RunRev Level: Provides a run level input. They do not require a transition for enable or fault, but a transition is still required for a stop.

ATTENTION: Changing parameter 89 to Terminal Blk or Network while Start At PowerUp is enabled may start the drive if a start command is on from the newly selected logic source.

When Start At PowerUp is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Removing and replacing the LCD HIM while the drive is running may cause an abrupt speed change if the LCD HIM is the selected reference source, but is not the selected control source. The drive will ramp to the reference level provided by the HIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142) and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

46 = Run w/Comm: Allows the comm start bit to operate like a run with the run input on the terminal block. Ownership rules apply.

47 = Hold Step: Inhibits profile from transitioning to next step when active.

48 = Set Home: The input establishes the “home” position in speed profiling.

49 = Find Home: Starts the commissioning procedure when a start command is issued to automatically position the motor to a home position established by a limit switch.

50 = Home Limit: This input is used for the “home” position.

51 = Vel Override: When active, multiplies value of Step X Velocity by % value in Vel Override.

52-56 = Pos Sel 1-5: The binary value of these inputs is used to select the starting step number for the profile.

57 = Prof Input: (Profile Input) Must be chosen if Step X Type is set to Dig Input and the digital input value that is entered in Step X Value is the value of this digital input selector.

Type 2 Alarms

Some digital input programming may cause conflicts that result in a Type 2 alarm. For example, Digital In1 Sel set to 5 (Start) in 3-wire control, and Digital In2 Sel set to 7 (Run) in 2-wire control.

377 Anlg1 Out Setpt
378 Anlg2 Out Setpt

Range: 0.000 to 20.000 mA or -/+10.000 V [0.001 mA or 0.001 V]

Default: 20.000 mA or 10.000 V

Access: 2 **Path:** Inputs & Outputs>Analog Outputs

See also:

Sets the analog output value from a communication device.

Example: Set Data In Ax (300-201) to 377 (value from communication device). Then set Analog Outx Sel (342, 345) to 24 = Param Cntl.

379 Dig Out Setpt

Range: See figure 3.35

Default: See figure 3.35

Access: 2 **Path:** Inputs & Outputs>Digital Outputs

See also: 380

Sets the digital output value from a communication device.

Example: Set Data In B1 (302) to 379. The first three bits of this value will determine the setting of Digital Outx Sel (380, 384, 388), which should be set to 30 = Param Cntl.

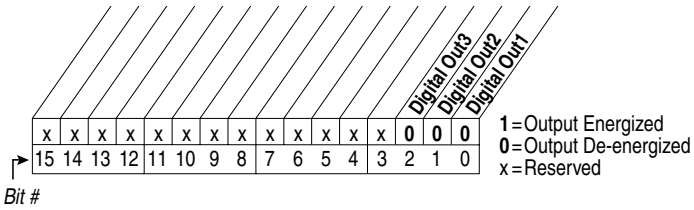

Digital Out3
Digital Out2
Digital Out1
x x x x x x x x x x x x x 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Output Energized
0 = Output De-energized
x = Reserved

Figure 3.35 – Dig Out Setpt

380 Digital Out1 Sel
384 Digital Out2 Sel
388 Digital Out3 Sel

Range:

1 = Fault
2 = Alarm
3 = Ready
4 = Run
5 = Forward Run
6 = Reverse Run
7 = Auto Restart
8 = Powerup Run
9 = At Speed
10 = At Freq
11 = At Current
12 = At Torque
13 = At Temp
14 = At Bus Volts
15 = At PI Error
16 = DC Braking
17 = Curr Limit
18 = Economize
19 = Motor Overld
20 = Power Loss
21 = Input 1 Link
22 = Input 2 Link
23 = Input 3 Link
24 = Input 4 Link
25 = Input 5 Link
26 = Input 6 Link
27 = PI Enable
28 = PI Hold
29 = Drive Overld
30 = Param Cntl
31 = Mask 1 AND
32 = Mask 1 OR
33 = Prof at Pos
34 = Prof Enabled
35 = Prof Running
36 = Prof Holding
37 = Prof At Home
38 = Prof Complete
39 = Prof Homing
40 = Prof Dwell
41 = Prof Batch
42 = Prof @ Step 1
43 = Prof @ Step 2
44 = Prof @ Step 3
45 = Prof @ Step 4
46 = Prof @ Step 5
47 = Prof @ Step 6
48 = Prof @ Step 7
49 = Prof @ Step 8
50 = Prof @ Step 9
51 = Prof @ Step 10
52 = Prof @ Step 11
53 = Prof @ Step 12

380 Digital Out1 Sel
384 Digital Out2 Sel
388 Digital Out3 Sel

	54 = Prof @ Step 13 55 = Prof @ Step 14 56 = Prof @ Step 15 57 = Prof @ Step 16 58 = TB in Manual
Default:	380: 1 = Fault 384: 4 = Run 388: 4 = Run
Access:	1 **Path:** Inputs & Outputs>Digital Outputs
See also:	1-4, 12, 48, 53, 137, 147, 157, 184, 218, 381-383, 385, 386, 390

Selects the drive status that will energize an output relay.

381 Digital Out1 Level
385 Digital Out2 Level
389 Digital Out3 Level

Range:	0.0 to 819.2 [0.1]
Default:	0.0
Access:	1 **Path:** Inputs & Outputs>Digital Outputs
See also:	380

Sets the relay activation level for options 10-15 in Digital Out"x" Sel. Units are assumed to match the above selection (i.e., At Freq = Hz, At Torque = Amps).

382 Digital Out1 OnTime
386 Digital Out2 OnTime
390 Digital Out3 OnTime

Range:	0.00 to 600.00 sec [0.1 sec]
Default:	0.00 sec
Access:	2 **Path:** Inputs & Outputs>Digital Outputs
See also:	380

Sets the on delay time for the digital outputs. This is the time between the occurrence of a condition and activation of the relay.

383 Digital Out1 OffTime
387 Digital Out2 OffTime
391 Digital Out3 OffTime

Range: 0.00 to 600.00 sec [0.1 sec]

Default: 0.00 sec

Access: 2 **Path:** Inputs & Outputs>Digital Outputs

See also: 380

Sets the off delay time for the digital outputs. This is the time between the disappearance of a condition and de-activation of the relay.

392 Dig Out Invert

Range: See figure 3.36

Default: See figure 3.36

Access: 2 **Path:** Inputs & Outputs>Digital Outputs

See also:

Inverts the selected digital output.

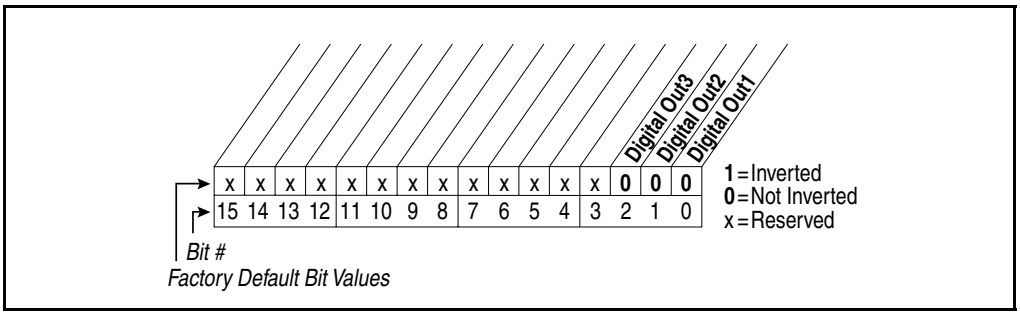

Digital Out3
Digital Out2
Digital Out1
x x x x x x x x x x x x x 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values
1 = Inverted
0 = Not Inverted
x = Reserved

Figure 3.36 – Dig Out Invert

393 Dig Out Param

Range: 0 = PI Config
1 = PI Status
2 = Drive Sts 1
3 = Drive Sts 2
4 = DriveAlarm1
5 = DriveAlarm2
6 = StartInhibit
7 = DigIn Status
8 = DrvSts1Flt
9 = DrvSts2Flt
10 = AlrmSts1Flt
11 = AlrmSts2Flt
12 = LogicCmdRslt
13 = Stop Owner
14 = Start Owner
15 = Jog Owner
16 = Dir Owner
17 = Ref Owner
18 = Accel Owner
19 = Decel Owner
20 = FltRst Owner
21 = MOP Owner
22 = Local Owner
23 = Limit Status
24 = PortMaskAct
25 = WriteMaskAct
26 = LogicMaskAct
27 = TorqProvCnfg
28 = TorqProvSet
29 = TorqProvSts
30 = Profile Sts
31 = Profile Cmd

Default: 0 = PI Config

Access: 2 **Path:** Inputs & Outputs>Digital Outputs

See also: 394

Selects the value that the mask [Dig Out Mask (394)] will be applied to.

394 Dig Out Mask

Range: See figure 3.37

Default: See figure 3.37

Access: 2 **Path:** Inputs & Outputs>Digital Outputs

See also: 393

Sets the mask that is applied to the selected value in Dig Out Param (393). A bit (AND/OR) is applied. The bit is selected by the Digital Outx Sel (380, 384,388). All bits with zeros in the mask are ignored.

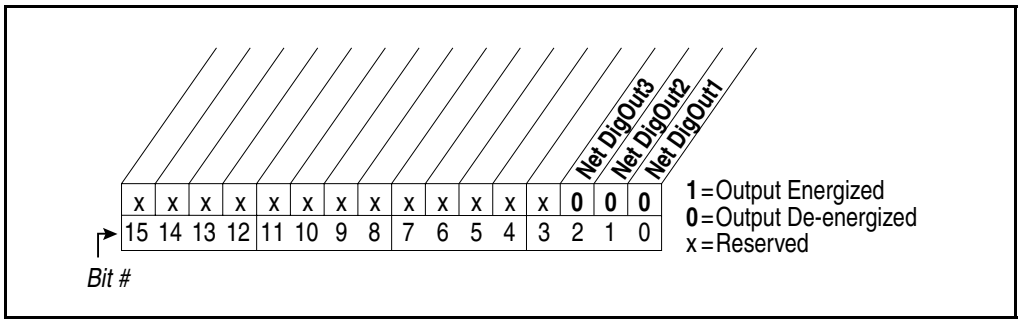

Net DigOut3
Net DigOut2
Net DigOut1
x x x x x x x x x x x x x 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Output Energized
0 = Output De-energized
x = Reserved

Figure 3.37 – Dig Out Mask

Example:

Mask OR: If any bits in the value are set in the mask, then the output is On.

Selected Value	0	0	0	0	1	1	0	0	1	1	1	1	0	0	0	0
Mask	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Result	Output On															

Mask AND: If all bits in the value are set in the mask, then the output is On.

Selected Value	0	0	0	0	1	1	0	0	1	1	1	1	0	0	0	0
Mask	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Result	Output Off															

412 Motor Fdbk Type

Range: 0 = Quadrature
1 = Quad Check
2 = Single Chan
3 = Single Check

Default: 0 = Quadrature

Access: 0 **Path:** Motor Control>Speed Feedback

See also:

Selects the encoder type - single channel or quadrature. Options 1 and 3 detect a loss of encoder signal (when using differential inputs) regardless of the Feedback Select (80) setting.

For FVC Vector mode, use a quadrature encoder only (option 0 or 1).

If a single channel encoder is used (option 2 or 3) in sensorless vector or V/Hz mode, select 2 = Reverse Dis in Direction Mode (190).

ATTENTION: When operating the drive with encoder feedback selected (Feedback Select (80) = 3 (Encoder)), a loss of encoder signal may produce an overspeed condition. For differential encoders, Motor Fdbk Type (412) should be selected as option 1 or 3 to detect the loss of an encoder signal. The user is responsible for ensuring that the driven machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. The factory default for overspeed detection is set to 10.0 Hz (or 300.0 RPM) greater than the Maximum Speed (82). Failure to observe this precaution could result in equipment damage, sever injury or loss of life.

413 Encoder PPR

Range: 2 to 20000 PPR [1 PPR]
Default: 1024 PPR
Access: 1 **Path:** Motor Control>Speed Feedback
See also:

Contains the encoder pulses per revolution. For improved operation in FVC Vector mode, PPR should meet or exceed (64 x motor poles).

414 Enc Position Fdbk

Range: -/+ 2147483647 [1]
Default: Read Only
Access: 1 **Path:** Motor Control>Speed Feedback
See also:

Displays raw encoder pulse count. For single channel encoders, this count will increase (per rev.) by the amount in Encoder PPR (413). For quadrature encoders, this count will increase by 4 times the amount defined in Encoder PPR (413).

415 Encoder Speed

Range: -/+ 420.0 Hz or -/+ 25200.0 RPM [0.1Hz or 0.1 RPM]
Default: Read Only
Access: 1 **Path:** Motor Control>Speed Feedback
See also: 79

Provides a monitoring point that reflects speed as seen from the feedback device.

416 Fdbk Filter Sel

Range: 0 = None
1 = Light
2 = Heavy

Default: 0 = None

Access: 1 **Path:** Motor Control>Speed Feedback

See also:

Selects the type of feedback filter desired. “Light” uses a 35/49 radian feedback filter. “Heavy” uses a 20/40 radian feedback filter.

419 Notch Filter Freq

FV

Range: 0.0 to 500.0 Hz [0.1 Hz]

Default: Read Only

Access: 1 **Path:** Motor Control>Speed Feedback

See also: 53

Sets the center frequency for an optional 2-pole notch filter. Filter is applied to the torque command. 0 disables this filter.

420 Notch Filter K

FV

Range: 0.1 to 0.9 Hz [0.1 Hz]

Default: 0.3 Hz

Access: 1 **Path:** Motor Control>Speed Feedback

See also: 53

Sets the gain for the 2-pole notch filter.

421 Marker Pulse

FV

Range: -/+ 2147483647 [1]

Default: Read Only

Access: 1 **Path:** Motor Control>Speed Feedback

See also:

Latches the raw encoder count at each marker pulse.

422 Pulse In Scale

FV

Range: 2 to 20000 [1]
Default: 64
Access: 1 **Path:** Motor Control>Speed Feedback
See also:

Sets the scale factor/gain for the Pulse Input when Encoder Z Chan (423) is set to Pulse Input. Calculate for desired speed command as follows:

For Hz, [Pulse In Scale] = Input Pulse Rate (Hz)/Desired Cmd. (Hz)

For RPM, [Pulse In Scale] = (Input Pulse Rate (Hz)/Desired Cmd. (Hz))/(120/Motor Poles)

423 Encoder Z Chan

FV

Range: 0 = Pulse Input
Default: 0 = Pulse Input
1 = Pulse Check
2 = Marker Input
3 = Marker Check
Access: 1 **Path:** Motor Control>Speed Feedback
See also:

Defines if the input wired to terminals 5 and 6 of the Encoder Terminal Block will be used as a Pulse or Marker Input. Options 1 and 3 detect a loss of signal (when using differential inputs) regardless of the Feedback Select (80) setting. When option 2 or 3 are used with Profile/Indexer Mode, the “homing” routine will position to the nearest marker pulse off of the home limit switch.

427 Torque Ref A Sel
431 Torque Ref B Sel

Range: 0 = Torque Stpt1
1 = Analog In 1
2 = Analog In 2
3-17 = Reserved
18 = DPI Port 1
19 = DPI Port 2
20 = DPI Port 3
21 = DPI Port 4
22 = DPI Port 5
23 = Reserved
24 = Disabled
25 = Scale Block 1
26 = Scale Block 2
27 = Scale Block 3
28 = Scale Block 4
29 = Torque Stpt2

Default: 427: 0 = Torque Stpt1
431: 24 = Disabled

Access: 1 **Path:** Motor Control>Torq Attributes

See also: 53

Selects the source of the external torque reference to the drive. How this reference is used is dependent upon [Speed/Torque Mod].

428 Torque Ref A Hi
432 Torque Ref B Hi

Range: -/+ 800.0% [0.1%]

Default: 100.0%

Access: 1 **Path:** Motor Control>Torq Attributes

See also: 53

Scales the upper value of the Torque Ref x Sel selection when the source is an analog input.

429 Torque Ref A Lo
433 Torque Ref B Lo

Range: -/+ 800.0% [0.1%]

Default: 0.0%

Access: 1 **Path:** Motor Control>Torq Attributes

See also: 53

Scales the lower value of the Torque Ref x Sel selection when the source is an analog input.

430 Torq Ref A Div

FV

Range: 0.1 to 3276.7 [0.1]
Default: 1.0
Access: 1 **Path:** Motor Control>Torq Attributes
See also: 53

Defines the value of the divisor for the Torque Ref A Sel (427) selection.

434 Torq Ref B Mult

FV

Range: -/+ 3276.7 [0.1]
Default: 1.0
Access: 1 **Path:** Motor Control>Torq Attributes
See also: 53

Defines the value of the multiplier for the Torque Ref B Sel (431) selection.

435 Torque Setpoint1

FV

Range: -/+ 800.0% [0.0%]
Default: 0.0%
Access: 1 **Path:** Motor Control>Torq Attributes
See also: 53

Provides an internal fixed value for Torque Setpoint when Torque Ref Sel is set to Torque Setpt.

436 Pos Torque Limit

FV

Range: 0.0 to 800.0% [0.1%]
Default: 200.0%
Access: 1 **Path:** Motor Control>Torq Attributes
See also: 53

Defines the torque limit for the positive torque reference value. The reference will not be allowed to exceed this value.

437 Neg Torque Limit

Range: -800.0% to 0.0 [0.1%]
Default: -200.0%
Access: 1 **Path:** Motor Control>Torq Attributes
See also: 53

Defines the torque limit for the negative torque reference value. The reference will not be allowed to exceed this value.

438 Torque Setpoint2

Range: -/+ 800.0% [0.1%]
Default: 0.0%
Access: 1 **Path:** Motor Control>Torq Attributes
See also:

Provides an internal fixed value for Torque Setpoint when Torque Ref Sel is set to Torque Setpt2.

440 Control Status

Range: See figure 3.38
Default: Read Only
Access: 1 **Path:** Motor Control>Torq Attributes
See also: 53

Displays a summary status of any condition that may be limiting either the current or the torque reference.

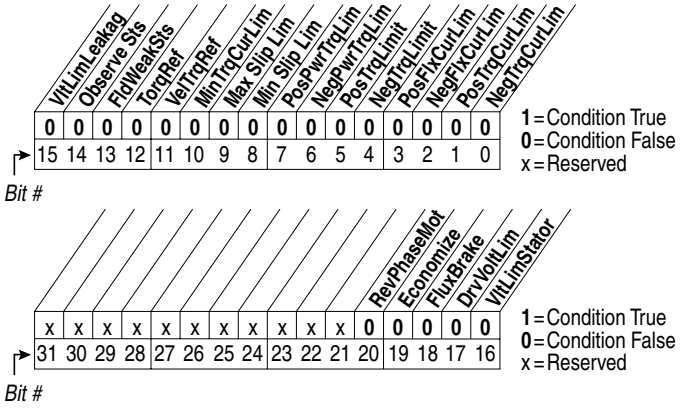


Figure 3.38 – Control Status

441 Mtr Tor Cur Ref

FV

Range: -/+ 32767.00 Amps [0.01 Amps]
Default: Read Only
Access: 1 **Path:** Motor Control>Torq Attributes
See also: 53

Displays the torque current reference value that is present at the output of Current Rate Lim (154).

445 Ki Speed Loop

FV

Range: 0.0 to 4000.0 [0.1]
Default: 7.8
Access: 2 **Path:** Speed Command>Speed Regulator
See also: 53

Controls the integral error gain of the speed regulator. The drive automatically adjusts Ki Speed Loop when a non-zero value is entered for Speed Desired BW (449) or an autotune is performed. Typically, manual adjustment of this parameter is needed only if system inertia cannot be determined through an autotune. Speed Desired BW (449) is set to 0 when a manual adjustment is made to this parameter.

446 Kp Speed Loop

FV

Range: 0.0 to 200.0 [0.1]
Default: 6.3
Access: 2 **Path:** Speed Command>Speed Regulator
See also: 53

Controls the proportional error gain of the speed regulator. The drive automatically adjusts Kp Speed Loop (446) when a non-zero value is entered for Speed Desired BW (449) or an auto-tune is performed. Typically, manual adjustment of this parameter is needed only if system inertia cannot be determined through an autotune. Speed Desired BW (449) is set to 0 when a manual adjustment is made to this parameter.

447 Kf Speed Loop

FV

Range: 0.0 to 0.5 [0.1]
Default: 0.0
Access: 2 **Path:** Speed Command>Speed Regulator
See also: 53

Controls the feed forward gain of the speed regulator. Setting of the Kf gain greater than zero reduces speed feedback overshoot in reponse to a step change in speed reference.

449 Speed Desired BW

FV

Range: 0.0 to 250.0 Radian/sec [0.1 Radian/sec]
Default: 0.0 Radians/sec
Access: 2 **Path:** Speed Command>Speed Regulator
See also: 53

Sets the speed loop bandwidth and determines the dynamic behavior of the speed loop. As bandwidth increases, the speed loop becomes more responsive and can track a faster changing speed reference.

Adjusting this parameter will cause the drive to calculate and change Ki Speed Loop (445) and Kp Speed Loop (447) gains.

450 Total Inertia

FV

Range: 0.01 to 600.0 sec [0.01 sec]
Default: 0.10 secs
Access: 2 **Path:** Speed Command>Speed Regulator
See also: 53

Represents the time in seconds for a motor coupled to a load to accelerate from zero to base speed at rated motor torque. The drive calculates Total Inertia during the autotune inertia procedure.

Adjusting this parameter will cause the drive to calculate and change Ki Speed Loop (445) and Kp Speed Loop (447) gains.

451 Speed Loop Meter

FV

Range: -/+ 800.0% /Hz/RPM [0.1%/Hz/RPM]
Default: Read Only
Access: 2 **Path:** Speed Command>Speed Regulator
See also: 53, 79, 121

Value of the speed regulator output.

454 Rev Speed Limit

FV

Range: -Max Speed to 0.0 Hz or -Max Speed to 0.0 RPM [0.0 Hz or 0.0 RPM]
Default: 0.0 RPM
Access: 1 **Path:** Speed Command>Speed Mode & Limits
See also:

Sets a limit on speed in the negative direction, when in FVC Vector mode. Used in bipolar mode only. A value of zero disables this parameter and uses Maximum Speed for reverse speed limit.

459 PI Deriv Time

Range: 0.00 to 100.00 secs [0.01 sec]
Default: 0.0 sec
Access: 2 **Path:** Speed Command>PI Process
See also:

FV

Refer to the formula below:

PI_{Out} = KD (Sec) x ($d_{PI\ Error}$ (%))/(d_t (Sec))

460 PI Reference Hi

Range: -/+ 100.00% [0.1%]
Default: 100.0%
Access: 2 **Path:** Speed Command>PI Process
See also:

Scales the upper value of PI Reference Sel (126) of the source.

461 PI Reference Lo

Range: -/+ 100.00% [0.1%]
Default: -100.0%
Access: 2 **Path:** Speed Command>PI Process
See also:

Scales the lower value of PI Reference Sel (126) of the source.

462 PI Feedback Hi

Range: -/+ 100.00% [0.1%]
Default: 100.0%
Access: 2 **Path:** Speed Command>PI Process
See also:

Scales the upper value of PI Feedback Sel (128) of the source.

463 PI Feedback Lo

Range: -/+ 100.00% [0.1%]
Default: 0.0%
Access: 2 **Path:** Speed Command>PI Process
See also:

Scales the lower value of PI Feedback Sel (128) of the source.

464 PI Output Gain

Range: -/+ 8.000 [0.001]
Default: 1.000
Access: 2 **Path:** Speed Command>PI Process
See also: 138

Sets the gain factor for PI Output Meter (138).

476 Scale1 In Value
482 Scale2 In Value
488 Scale3 In Value
494 Scale4 In Value

Range: -/+ 32767.000 [0.001]
Default: 0.00
Access: 2 **Path:** Utility>Scaled Blocks
See also:

Displays the value of the signal being sent to ScaleX In Value using a link.

477 Scale1 In Hi
483 Scale2 In Hi
489 Scale3 In Hi
495 Scale4 In Hi

Range: -/+ 32767.000 [0.001]
Default: 0.00
Access: 2 **Path:** Utility>Scaled Blocks
See also:

Scales the upper value of ScaleX In Value.

478 Scale1 In Lo
484 Scale2 In Lo
490 Scale3 In Lo
496 Scale4 In Lo

Range: -/+ 32767.000 [0.001]

Default: 0.00

Access: 2 **Path:** Utility>Scaled Blocks

See also:

Scales the lower value of ScaleX In Value.

479 Scale1 Out Hi
485 Scale2 Out Hi
491 Scale3 Out Hi
497 Scale4 Out Hi

Range: -/+ 32767.000 [0.001]

Default: 0.00

Access: 2 **Path:** Utility>Scaled Blocks

See also:

Scales the upper value of ScaleX Out Value.

480 Scale1 Out Lo
486 Scale2 Out Lo
492 Scale3 Out Lo
498 Scale4 Out Lo

Range: -/+ 32767.000 [0.001]

Default: 0.00

Access: 2 **Path:** Utility>Scaled Blocks

See also:

Scales the lower value of ScaleX Out Value.

481 Scale1 Out Value
487 Scale2 Out Value
493 Scale3 Out Value
499 Scale4 Out Value

Range: -/+ 32767.000 [0.001]

Default: Read Only

Access: 2 **Path:** Utility>Scaled Blocks

See also:

Value of the signal being sent out of the Universal Scale Block. Typically this value is used as the source of information and will be linked to another parameter.

Parameters 500 - 598 are found in the Advanced Tuning Parameters Section (Section 3.2).

600 TorqProve Cnfg

Range: See figure 3.39

Default: See figure 3.39

Access: 2 **Path:** Applications>Torque Proving

See also:

Enables/disables torque/brake proving feature. When Enabled, Digital Out1 Sel (380) becomes the brake control.

This value is not changed when parameters are reset to factory defaults.

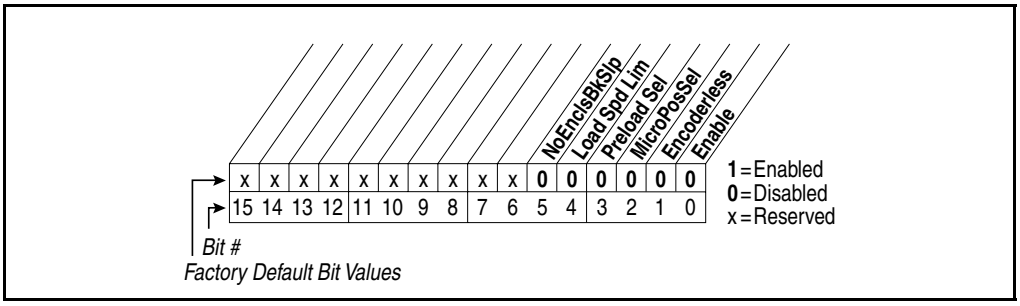

NoEnclsBkSlp
Load Spd Lim
Preload Sel
MicroPosSel
Encoderless
Enable
x x x x x x x x x x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values
1 = Enabled
0 = Disabled
x = Reserved

Figure 3.39 – TorqProve Cnfg

Enable = Enables Torque Proving features.

Encoderless = Enables encoderless operation - bit 0 must also be enabled.

MicroPosSel = A “1” allows the Micro Position digital input to change the speed command while the drive is running.

Preload Sel = “0” uses the last torque for preload. “1” uses “TorqRef A” if commanded direction is forward and “TorqRef B” for reverse.

Load Spd Lim = Enables drive to perform load calculation at base speed. Drive will then limit operation above base speed depending on load.

NoEncIsBkSlp = A “1” disables the partial Brake Slip routine from the drive when encoderless is selected.

601 TorqProve Setup

Range: See figure 3.40
Default: See figure 3.40
Access: 2 **Path:** Applications>Torque Proving
See also:

Allows control of specific torque proving functions through a communication device.

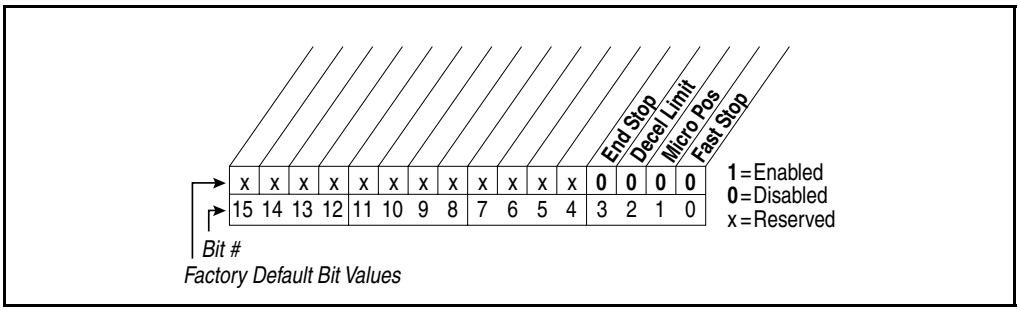

End Stop
Decel Limit
Micro Pos
Fast Stop
x x x x x x x x x x x x 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
1 = Enabled
0 = Disabled
x = Reserved
Bit #
Factory Default Bit Values

Figure 3.40 – TorqProve Setup

602 Spd Dev Band

Range: 0.1 to 15.0 Hz or 3.0 to 450.0 RPM [0.1 Hz or 0.1 RPM]
Default: 2.0 Hz or 60.0 RPM
Access: 2 **Path:** Applications>Torque Proving
See also: 603

Defines the allowable difference between the commanded frequency and encoder feedback value. A fault will occur when the difference exceeds this value for a period of time.

603 Spd Band Integrat

Range: 1 to 200 mSec [1 mSec]
Default: 60 mSec
Access: 2 **Path:** Applications>Torque Proving
See also: 602

Sets the amount of time before a fault is issued when Spd Dev Band (602) is outside its threshold.

604 Brk Release Time

Range: 0.00 to 10.00 sec [0.01 sec]
Default: 0.10 sec
Access: 2 **Path:** Applications>Torque Proving
See also:

Sets the amount of time between commanding the brake to release and the start of drive acceleration. In Encoderless mode, this parameter sets the time to release the brake after the drive starts.

605 ZeroSpdFloatTime

Range: 0.1 to 500.0 sec [0.1 sec]
Default: 5.0 sec
Access: 2 **Path:** Applications>Torque Proving
See also:

Sets the amount of time the drive is below Float Tolerance (606) before the brake is set. Not used in Encoderless Torque Prove mode.

606 Float Tolerance

Range: 0.1 to 5.0 Hz or 3.0 to 150.0 RPM [0.1 Hz or 0.1RPM]
Default: 0.2 Hz or 6.0 RPM
Access: 2 **Path:** Applications>Torque Proving
See also:

Sets the frequency level where the float timer starts. Also sets the frequency level where the brake will be closed in Encoderless Torque Prove mode.

607 Brk Set Time

Range: 0.00 to 10.00 sec [0.01 sec]
Default: 0.10 sec
Access: 2 **Path:** Applications>Torque Proving
See also:

Defines the amount of delay time between commanding the brake to be set and the start of brake proving.

608 TorqLim SlewRate

Range: 0.5 to 300.0 sec [0.1 sec]
Default: 10.0 sec
Access: 2 **Path:** Applications>Torque Proving
See also:

Sets the rate to ramp the torque limits to zero during brake proving.

609 BrkSlip Count

Range: 0 to 65535 [1]
Default: 250
Access: 2 **Path:** Applications>Torque Proving
See also:

Sets the number of encoder counts to define a brake slippage condition.

610 Brk Alarm Travel

Range: 0.0 to 1000.0 Revs [0.1 Revs]
Default: 1.0 Revs
Access: 2 **Path:** Applications>Torque Proving
See also:

Sets the number of motor shaft revolutions allowed during the brake slippage test. Drive torque is reduced to check for brake slippage. When slippage occurs, the drive allows this number of motor shaft revolutions before regaining control. Not used in Encoderless Torque Prove mode.

611 MicroPos Scale%

Range: 0.1 to 100.0% [0.1%]
Default: 10.0%
Access: 2 **Path:** Applications>Torque Proving
See also: 361-366

Sets the percent of speed reference to be used when micropositioning has been selected. Motor must come to a stop before this setting will take effect.

612 Torq Prove Sts

Range: See figure 3.41
Default: Read Only
Access: 2 **Path:** Applications>Torque Proving
See also:

Displays the status bits for Torque Proving.

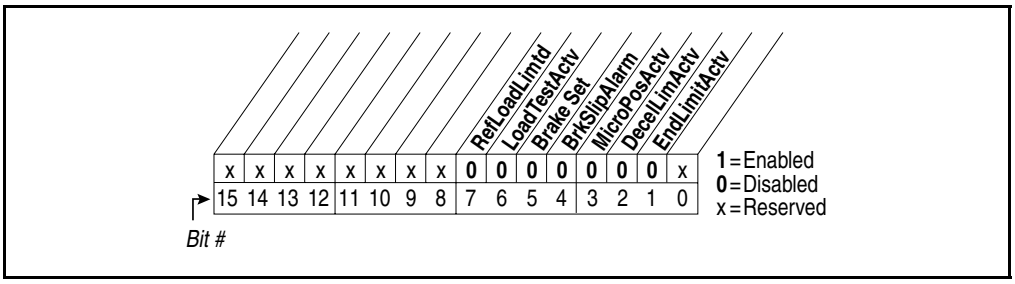


Figure 3.41 – Torq Prove Sts

631 Rod Load Torque

Range: 0.00 to 32000.00 ft-lb [0.01 ft-lb]
Default: Read Only
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Displays the load side torque.

632 TorqAlarm Level

Range: 0.00 to 5000.00 ft-lb [0.01 ft-lb]
Default: 0.00 ft-lb
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Sets the level at which the Torque Alarm becomes active.

633 TorqAlarm Action

Range: 0 = No Action
1 = Goto Preset 1
Default: 0 = No Action
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Sets the drive action when the Torque Alarm is exceeded.

634 TorqAlarm Dwell

Range: 0.0 to 60.0 sec [0.1 sec]
Default: 0.0 sec
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Sets the time that the torque must exceed [TorqAlarm Level (632)] before TorqAlarm Action (633) occurs.

635 TorqAlrm Timeout

Range: 0.0 to 600.0 sec [0.1 sec]
Default: Read Only
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Sets the amount of time a Torque Alarm can be active until timeout action begins.

636 TorqAlrm TO Act

Range: 0 = Resume
1 = Fault Drive
Default: 0 = Resume
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Sets the drive action when TorqAlrm Timeout (635) is exceeded.

637 PCP Pump Sheave

Range: 0.25 to 200.00 inches [0.01 inches]
Default: 20.0 Inch
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Displays the diameter of the sheave on the pump.

638 Max Rod Torque

Range: 0.0 to 3000.0 ft/lb [0.1 ft/lb]
Default: 500.0 ft/lb
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Displays the maximum torque on the polished rod in a PCP oil well application.

639 Min Rod Speed

Range: 0.0 to 199.0 RPM [0.1 RPM]
Default: 0.0 RPM
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Minimum speed for the polished rod in a PCP oil well application. Parameter related to motor minimum speed through total gear ratio.

640 Max Rod Speed

Range: 200.0 to 600.0 RPM [0.1 RPM]
Default: 300.0 RPM
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Maximum speed for the polished rod in a PCP oil well application. Parameter related to motor minimum speed through total gear ratio.

641 OilWell Pump Sel

Range: 0 = Disable
1 = Pump Jack
2 = PC Oil Well
Default: 0 = Disable
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Selects the type of oil well application.

0 = Disable: Disconnects binding of oil well parameters.

1 = Pump Jack: Sets parameters and bindings based on Pump Jack type oil well

2 = PC Oil Well: Sets parameters and bindings based Progressive Cavity type Pumps

642 Gearbox Rating

Range: 16 to 2560 Kin lbs. [0.1 Kin Lb.]
Default: 640.0 Kin Lb.
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Sets the Gearbox ratio rating in K inch-lbs.

Example: A 912 gearbox is rated as 912,000 in-lbs. If the client enters in the value of 912, the calculations for the parameters should use a value of 912,000.

643 Gearbox Sheave

Range: 0.25 to 100.00 inches [0.01 inch]
Default: 0.25 Inch
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Displays the diameter of the Sheave on the Gearbox measured in inches.

644 Gearbox Ratio

Range: 1.00 to 40.00 [0.01]
Default: 1.00
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Gear ratio taken directly off of the name plate information of the gearbox ratio. The ratio is typically specified as X:1.

645 Motor Sheave

Range: 0.25 to 25.00 Inches [0.01]
Default: 10.00
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Sets the sheave diameter on the motor.

646 Total Gear Ratio

Range: 0.00 to 32000.00 [0.01]
Default: Read Only
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Displays the calculated total gear ratio as follows:

[(Gearbox Sheave) x (Gearbox Ratio)]/[Motor Sheave]

647 DB Resistor

Range: 0.0 to 100.0 Ohms [0.1]
Default: 10.4
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Calculates the negative torque maximum available from the dynamic brake resistor.

648 Gearbox Limit

Range: 0.0 to 200.0% [0.1%]
Default: 100.0 %
Access: 2 **Path:** Applications>Oil Well Pump
See also:

Sets the gearbox torque limit. This value is used in determining the Pos Torque Limit (436) and Neg Torque Limit (437).

650 Adj Volt Phase

Range: 0 = 1 Phase
1 = 3 Phase
Default: 1 = 3 Phase
Access: 2 **Path:** Applications>Adjust Voltage
See also:

Selects the type voltage.

0 = 1 Phase: Operates single phase loads connected to the U and V phases. Not designed to operate single phase motors.

1 = 3 Phase: Operates three phase loads.

651 Adj Volt Select

Range: 0 = Reserved
1 = Analog In 1
2 = Analog In 2
3-6 = Reserved
7-8 = Not Used
9 = MOP Level
10 = Reserved
11-17 = Preset Volt 1-7
18-22 = DPI Port 1-5

Default: 2 = Analog In 2

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Selects the source of the voltage reference to the drive.

652 Adj Volt Ref Hi

Range: -/+ 100.0% of Drive Rated Volts [0.1%]

Default: 100.0%

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Scales the upper value of the Adj Volt Select (651) selection when the source is in any analog input.

653 Adj Volt Ref Lo

Range: -/+ 100.0% of Drive Rated Volts [0.1%]

Default: 100.0%

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Scales the lower value of the Adj Volt Select (651) selection when the source is in any analog input.

654 Adj Volt Preset 1
655 Adj Volt Preset 2
656 Adj Volt Preset 3
657 Adj Volt Preset 4
658 Adj Volt Preset 5
659 Adj Volt Preset 6
660 Adj Volt Preset 7

Range: 0.0/Drive Rated Volts [0.1 VAC]

Default: 0.0 VAC

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Provides an internal fixed voltage command value that is available as a selection for Adj Volt Select (651).

661 Min Adj Voltage

Range: 0.0/Drive Rated Volts [0.1 VAC]

Default: 0.0 VAC

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Sets the low limit for the voltage reference when Motor Cntrl Sel (53) is set to “Adj Voltage.”

662 Adj Volt Command

Range: 0.0/Drive Rated Volts [0.1 VAC]

Default: Read Only

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Displays the voltage value of the reference specified Adj Volt Select (651).

663 MOP Adj VoltRate

Range: 0.1 to 100.0 V/s [0.1 V/s]

Default: Read Only

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Sets the rate for the MOP.

669 Adj Volt TrimSel

Range: 0 = Reserved
1 = Analog In 1
2 = Analog In 2
3-6 = Reserved
7-8 = Not Used
9 = MOP Level
10 = Reserved
11-17 = Preset Volt 1-7
18-22 = DPI Port 1-5
24 = Output Power
25 = Out Current

Default: 2 = Analog In 2

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Selects the source of the voltage trim that is added to or subtracted from the voltage reference.

670 Adj Volt Trim Hi

Range: 0.0 to 100.0% of Drive Rated Volts [0.1%]

Default: 100.0%

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Scales the upper value of the Adj Volt TrimSel (669) selection when the source is an analog input.

671 Adj Volt Trim Lo

Range: 0.0 to 100.0% of Drive Rated Volts [0.1%]

Default: 0.0%

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Scales the lower value of the Adj Volt TrimSel (669) selection when the source is an analog input.

672 Adj Volt Trim %

Range: -/+100.0% of Drive Rated Volts [0.1%]

Default: 0.0%

Access: 2 **Path:** Applications>Adjust Voltage

See also:

Scales the total voltage trim value from all sources. Analog In 1 and 2 are scaled separately with Adj Volt Trim Hi (670) and Adj Volt Trim Lo (671), and then Adj Volt Trim % (672) sets the trim value. The sign of this value will determine if trim is added or subtracted from the reference.

675 Adj Volt AccTime

Range: 0.0 to 3600.0 Secs [0.1 Secs]
Default: 0.0 Secs
Access: 2 **Path:** Applications>Adjust Voltage
See also:

Sets the rate of voltage increase. The value will be the time it takes to ramp the voltage from Min Adj Voltage (661) to Maximum Voltage (54). An “S” curve can be applied to the ramp using Adj Volt S Curve (677).

676 Adj Volt DecTime

Range: 0.0 to 3600.0 Secs [0.1 Secs]
Default: 0.0 Secs
Access: 2 **Path:** Applications>Adjust Voltage
See also:

Sets the rate of voltage decrease. The value will be the time it takes to ramp the voltage from Maximum Voltage (54) to Min Adj Voltage (661). An “S” curve can be applied to the ramp using Adj Volt S Curve (677).

Important: This ramp and Decel Time 1 (142) and Decel Time 2 (143) must ramp to zero for the drive to stop.

677 Adj Volt S Curve

Range: 0.0 to 100.0% [0.1%]
Default: 0.0%
Access: 2 **Path:** Applications>Adjust Voltage
See also:

Sets the percentage of accel or decel timet to be applied to the voltage ramp as “S” curve. Time is added 1/2 at the beginning and 1/2 at the end.

700 Profile Status

Range: See figure 3.42
Default: Read Only
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Provides status of the profile/indexer. Bits 0-4 are a binary value.

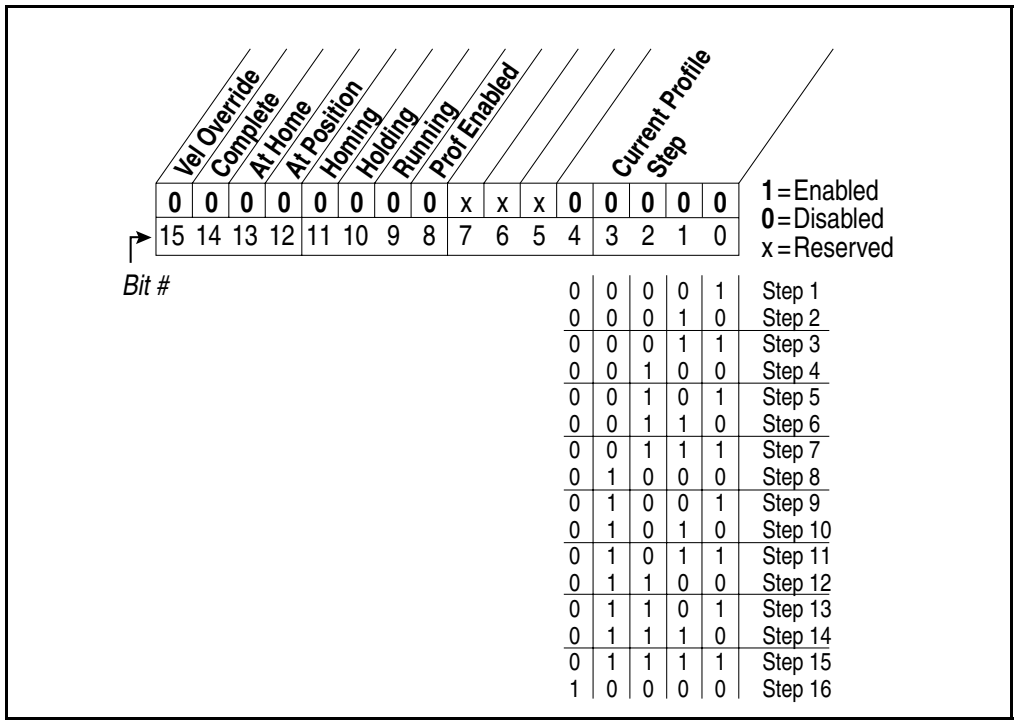

Vel Override
Complete
At Home
At Position
Homing
Holding
Running
Prof Enabled
Current Profile Step
0 0 0 0 0 0 0 0 x x x 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
1 = Enabled
0 = Disabled
x = Reserved
0 0 0 0 1 Step 1
0 0 0 1 0 Step 2
0 0 0 1 1 Step 3
0 0 1 0 0 Step 4
0 0 1 0 1 Step 5
0 0 1 1 0 Step 6
0 0 1 1 1 Step 7
0 1 0 0 0 Step 8
0 1 0 0 1 Step 9
0 1 0 1 0 Step 10
0 1 0 1 1 Step 11
0 1 1 0 0 Step 12
0 1 1 0 1 Step 13
0 1 1 1 0 Step 14
0 1 1 1 1 Step 15
1 0 0 0 0 Step 16

Figure 3.42 – Pos/Spd Prof Sts

701 Units Traveled

Range: -/+ 214748352.00 [0.01]
Default: Read Only
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Number of units traveled from the home position.

705 Profile Command

Range: See figure 3.43
Default: See figure 3.43
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Control word for the profile/indexer. The control functions are the same as those in the digital input section. If a digital input is configured to provide the starting step (bits 0-4), then its starting step value takes priority over Profile Command. If a digital input is configured for any of bits 8-12, the corresponding functions will respond to the digital input status or the status of Profile Command.

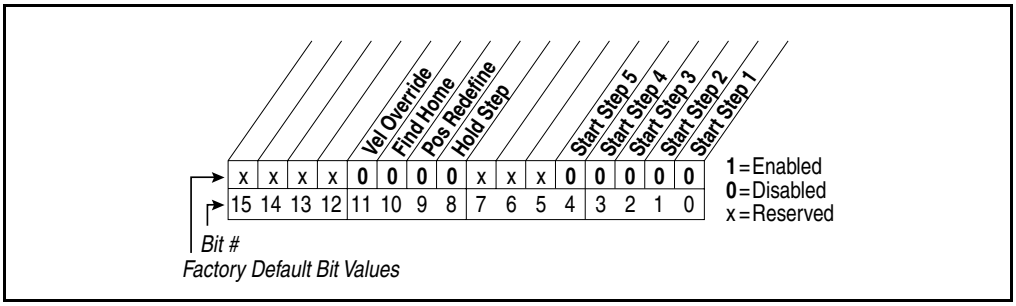

Vel Override
Find Home
Pos Redefine
Hold Step
Start Step 5
Start Step 4
Start Step 3
Start Step 2
Start Step 1
x x x x 0 0 0 0 x x x 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
1 = Enabled
0 = Disabled
x = Reserved
Bit #
Factory Default Bit Values

Figure 3.43 – Profile Command

707 Encoder Pos Tol

Range: 1 to 50000 [1]
Default: 10
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Sets the “At Position” tolerance window (See Profile Status (700) bit 12) around the encoder count. The value is subtracted from and added to the encoder unit value. It is applied to all steps using encoder units.

708 Counts per Unit

Range: 1 to 1000000 [1]
Default: 4096
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Sets the number of encoder counts equal to one unit. A 1024 RPM quadrature encoder has 4096 pulses in one revolution.

711 Vel Override

Range: 10.0 to 150.0% [0.1%]
Default: 100.0%
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

This value is a multiplier to the Step x Velocity value when “Vel Override” bit of Profile Command (705) is set to 1. This is applicable to all step types.

713 Find Home Speed

Range: -/+ 50.0% of Maximum Speed [0.1 Hz or 0.1 RPM]
Default: +10.0% of Maximum Speed
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Sets the speed and direction that are active when “Find Home” of Profile Command (705) is active. The sign of the value defines direction (“+” = Forward, “-” = Reverse).

714 Find Home Ramp

Range: 0.0 to 3600.0 sec [0.1sec]
Default: 10.0 sec
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Sets the rate of acceleration and deceleration of the Find Home moves.

718 Pos Reg Filter

Range: 0.0 to 500.0 [0.1]
Default: 25.0
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Sets the error signal filter in the position regulator.

719 Pos Reg Gain

Range: 0.0 to 200.0 [0.1]
Default: 4.0
Access: 2 **Path:** Pos/Spd Profile>ProfSetup/Status
See also:

Sets the gain adjustment for the position regulator.

720 Step 1 Type
730 Step 2 Type
740 Step 3 Type
750 Step 4 Type
760 Step 5 Type
770 Step 6 Type
780 Step 7 Type
790 Step 8 Type
800 Step 9 Type
810 Step 10 Type
820 Step 11 Type
830 Step 12 Type
840 Step 13 Type
850 Step 14 Type
860 Step 15 Type
870 Step 16 Type

Range:
0 = End
1 = Time
2 = Time Blend
3 = Dig Input
4 = Encoder Incr
5 = EnclncrBlend
6 = Enc Absolute
7 = End Hold Pos
8 = Param Level

Default: 1 = Time
Access: 2 **Path:** Pos/Spd Profile>Profile Step 1-16
See also:

Selects the type of move for a particular step.

The following steps use the **velocity regulator** only:

0 = End: Drive ramps to zero speed and stops the profile after the programmed dwell time.

1 = Time: Drive ramps to step velocity, holds speed and decels to zero in specified step value time.

2 = Time Blend: Drive ramps to step velocity and holds speed until step value time completes and then transitions to step defined in step next.

3 = Dig Input: Drive ramps to step velocity, holds speed until digital input specified in step value transitions in the direction defined by sign of step value.

5 = EnclncrBlend: Drive ramps to step velocity, holds speed, when at encoder position defined by step value within tolerance window transition to step next.

8 = Param Level: Drive ramps to step velocity, holds speed, and compares step value to step dwell. The sign of step value ("+" = >, "-" = <) determines when to transition to next step.

The following step types use the point-to-point **position regulator**:

4 = Encoder Incr: Drive ramps to step velocity, holds speed then ramps to zero at encoder position defined by step value within position tolerance window.

6 = Enc Absolute: Drive ramps to step velocity in direction required, holds speed, then ramps to zero at position within tolerance window.

7 = End Hold Pos: Drive holds last position for step dwell time then stops.

The drive must have Direction Mode (190) set to Bipolar for the position regulator to function properly. Current Limits, Torque Limits and Regen Power Limits must be set so as not to limit the programmed deceleration time. If one of the limits occur, the position regulator may overshoot the position set point.

721 Step 1 Velocity
731 Step 2 Velocity
741 Step 3 Velocity
751 Step 4 Velocity
761 Step 5 Velocity
771 Step 6 Velocity
781 Step 7 Velocity
791 Step 8 Velocity
801 Step 9 Velocity
811 Step 10 Velocity
821 Step 11 Velocity
831 Step 12 Velocity
841 Step 13 Velocity
851 Step 14 Velocity
861 Step 15 Velocity
871 Step 16 Velocity

Range:	-/+ Maximum Speed [0.1 Hz or 0.1 RPM]	
Default:	0.0	
Access:	2	**Path:** Pos/Spd Profile>Profile Step 1-16
See also:		

This is the step speed. The sign of this value is used to determine direction for Time, Time Blended, Digital Input and Parameter Level step types. The value is an absolute number for all Encoder step types.

722 Step 1 AccelTime
732 Step 2 AccelTime
742 Step 3 AccelTime
752 Step 4 AccelTime
762 Step 5 AccelTime
772 Step 6 AccelTime
782 Step 7 AccelTime
792 Step 8 AccelTime
802 Step 9 AccelTime
812 Step 10 AccelTime
822 Step 11 AccelTime
832 Step 12 AccelTime
842 Step 13 AccelTime
852 Step 14 AccelTime
862 Step 15 AccelTime
872 Step 16 AccelTime

Range:	0.0 to 3600.0 sec [0.1 sec]		
Default:	10.0 sec		
Access:	2	**Path:**	Pos/Spd Profile>Profile Step 1-16
See also:			

This is the acceleration rate for the step. Sets the time to ramp from zero to Maximum Speed.

723 Step 1 DecelTime
733 Step 2 DecelTime
743 Step 3 DecelTime
753 Step 4 DecelTime
763 Step 5 DecelTime
773 Step 6 DecelTime
783 Step 7 DecelTime
793 Step 8 DecelTime
803 Step 9 DecelTime
813 Step 10 DecelTime
823 Step 11 DecelTime
833 Step 12 DecelTime
843 Step 13 DecelTime
853 Step 14 DecelTime
863 Step 15 DecelTime
873 Step 16 DecelTime

Range:	0.0 to 3600.0 sec [0.1 sec]
Default:	10.0 sec
Access:	2 **Path:** Pos/Spd Profile>Profile Step 1-16
See also:	

This is the deceleration rate for the step. Sets the time to ramp from Maximum Speed to zero.

724 Step 1 Value
734 Step 2 Value
744 Step 3 Value
754 Step 4 Value
764 Step 5 Value
774 Step 6 Value
784 Step 7 Value
794 Step 8 Value
804 Step 9 Value
814 Step 10 Value
824 Step 11 Value
834 Step 12 Value
844 Step 13 Value
854 Step 14 Value
864 Step 15 Value
874 Step 16 Value

Range:	Based on Step x Type [0.01]		
Default:	6.0		
Access:	2	**Path:**	Pos/Spd Profile>Profile Step 1-16
See also:			

Sets the step value used for time, digital input number, parameter level and encoder units. It is used to determine the condition to move to the next step.

Time: 0.00 to 3600.00 seconds

Digital Input: 1 to 6 (decimal ignored). The sign value “+” makes inputs “active high” and a “-” makes them “active low”.

Parameter Level: Parameter Number

Encoder: Units

725 Step 1 Dwell
735 Step 2 Dwell
745 Step 3 Dwell
755 Step 4 Dwell
765 Step 5 Dwell
775 Step 6 Dwell
785 Step 7 Dwell
795 Step 8 Dwell
805 Step 9 Dwell
815 Step 10 Dwell
825 Step 11 Dwell
835 Step 12 Dwell
845 Step 13 Dwell
855 Step 14 Dwell
865 Step 15 Dwell
875 Step 16 Dwell

Range:	Based on Step x Type [0.01]	
Default:	00.0	
Access:	2	**Path:** Pos/Spd Profile>Profile Step 1-16
See also:		

After the condition to move to the next step has been satisfied, the drive continues at its present velocity or position until the dwell time expires, at which point the next step is executed.

726 Step 1 Batch
736 Step 2 Batch
746 Step 3 Batch
756 Step 4 Batch
766 Step 5 Batch
776 Step 6 Batch
786 Step 7 Batch
796 Step 8 Batch
806 Step 9 Batch
816 Step 10 Batch
826 Step 11 Batch
836 Step 12 Batch
846 Step 13 Batch
856 Step 14 Batch
866 Step 15 Batch
876 Step 16 Batch

Range:	0 to 1000000 [1]		
Default:	1		
Access:	2	**Path:**	Pos/Spd Profile>Profile Step 1-16
See also:			

Sets the number of time to run this step.

0 = continuously run this step.

727 Step 1 Next
737 Step 2 Next
747 Step 3 Next
757 Step 4 Next
767 Step 5 Next
777 Step 6 Next
787 Step 7 Next
797 Step 8 Next
807 Step 9 Next
817 Step 10 Next
827 Step 11 Next
837 Step 12 Next
847 Step 13 Next
857 Step 14 Next
867 Step 15 Next
877 Step 16 Next

Range:	1 to 16 [1]
Default:	Step 1 = 2 Step 2 = 3 Step 3 = 4 Step 4 = 5 Step 5 = 6 Step 6 = 7 Step 7 = 8 Step 8 = 9 Step 9 = 10 Step 10 = 11 Step 11 = 12 Step 12 = 13 Step 13 = 14 Step 14 = 15 Step 15 = 16 Step 16 = 0
Access:	2 **Path:** Pos/Spd Profile>Profile Step 1-16
See also:	

Sets the step number to execute after this step is complete (including Step X Batch.

3.2 Advanced Tuning Parameters (Vector Control Only)

ATTENTION: To guard against unstable or unpredictable operation, the following parameters must only be changed by qualified service personnel. Failure to observe this precaution could result in damage to equipment or severe bodily injury.

The following parameters can only be viewed when the parameter acces level is set to “2 = Advanced” in Param Access Lvl (196).

500 KI Current Limit

Range: 0 to 10000 [1]
Default: 1500
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Current Limit Integral gain. This gain is applied to the current limit error signal to eliminate steady state current limit error. A larger value increases overshoot during a step of motor current/load.

501 KD Current Limit

Range: 0 to 10000 [1]
Default: 500
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Current Limit Derivative gain. This gain is applied to the sensed motor current to anticipate a current limit condition. A larger value reduces overshoot of the current relative to the current limit value.

502 Bus Reg ACR Kp

Range: 0 to 10000 [1]
Default: 450
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

This proportional gain, in conjunction with Bus Reg Ki (160), adjusts the output frequency of the drive during a bus limit or inertia ride through condition. The output frequency is adjusted in response to an error in the active, or torque producing, current to maintain the active bus limit, or inertia ride through bus reference. A larger value of gain reduces the dynamic error of the active current.

503 Jerk

Range: 2 to 30000 [1]
Default: 900
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Adjusts the amount of S-Curve or “Jerk” applied to the Acc/Dec rate. To enable the Jerk feature, bit 1 of Compensation (56) must be set high.

504 Kp LL Bus Reg

Range: 0 to 10000 [1]
Default: 500
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

This proportional gain adjusts the active current command during an inertia-ride through condition, in response to a bus error. A larger value of gain reduces the dynamic error of the bus voltage as compared to the bus voltage reference.

505 Kd LL Bus Reg

Range: 0 to 10000 [1]
Default: 500
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Line Loss Bus Reg Kd is a derivative gain, which is applied to the sensed bus voltage to anticipate and minimize dynamic changes. A larger value reduces overshoot of the bus voltage relative to the inertia-ride through bus voltage reference.

506 Angl Stblty Gain

Range: 0 to 32767 [1]
Default: 51
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Angle Stability Gain adjusts the electrical angle to maintain stable motor operation. An increase in the value increases the angle adjustment.

507 Volt Stblty Gain

Range: 0 to 32767 [1]
Default: 93
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Adjusts the output voltage to maintain stable motor operation. An increase in the value increases the output voltage adjustment.

508 Stability Filter

Range: 0 to 32767 [1]
Default: 3250
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

The Stability Filter coefficient is used to adjust bandwidth of a low pass filter. The smaller the value of this coefficient, the lower the bandwidth of the filter.

509 Low Freq Reg Kpld

Range: 0 to 32767 [1]
Default: 64
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

This proportional gain adjusts the output voltage at very low frequency in response to the reactive, or d-axis, motor current. A larger value increases the output voltage change.

510 Low Freq Reg Kplq

Range: 0 to 32767 [1]
Default: 64
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

The proportional gain adjusts the output voltage at very low frequency in response to the active, or q-axis, motor current. A larger value increases the output voltage change.

511 KI Cur Reg

Range: 0 to 32767 [1]
Default: 44
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

This integral gain adjusts the output voltage in response to the q and d axis motor currents. A larger value increases the output voltage change.

512 Kp Cur Reg

Range: 0 to 32767 [1]
Default: 1600
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

This proportional gain adjusts the output voltage in response to the q and d axis motor currents. A larger value increases the output voltage change.

513 PWM DAC Enable

Range: 0 to 1 [1]
Default: 0
Access: 2 **Path:** Utility>Diag-DACS
See also:

Reserved. Do not adjust.

514 DAC47-A
515 DAC47-B
516 DAC47-C
517 DAC47-D

Range: 0 to 7432 [1]
Default: 0
Access: 2 **Path:** Utility>Diag-DACS
See also:

Reserved. Do not adjust.

518 Host DAC Enable

Range: 0 to 1 [1]
Default: 0
Access: 2 **Path:** Utility>Diag-DACS
See also:

Reserved. Do not adjust.

519 DAC55-A
520 DAC55-B
521 DAC55-C
522 DAC55-D

Range: 0 to 7432 [1]
Default: 0
Access: 2 **Path:** Utility>Diag-DACS
See also:

Reserved. Do not adjust.

523 Bus Utilization

Range: 85.0 to 100.0% [0.1%]
Default: 95.0%
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Sets the drive output voltage limit as a percentage of the fundamental output voltage when operating in 6 step mode. Values above 95% increase harmonic content and jeopardize control stability. This output voltage limit is strictly a function of input line and resulting bus voltage.

524 PWM Type Select

Range: 0 to 1 [1]
Default: 0
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Allows selection of active PWM type. A value of 0 is default and results in a change of PWM method at approximately 2/3 of rated motor frequency. If this is unacceptable for harmonic or audible reasons, a value of 1 disables the change.

525 Torque Adapt Spd

Range: 0.0 to 100.0% [0.1%]
Default: 10.0%
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Selects the operating frequency/speed at which the adaptive torque control regulators become active as a percent of motor nameplate frequency.

526 Torq Reg Enable

Range: 0 to 1 [1]
Default: 1
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Enables or disables the torque regulator.

527 Kp Torque Reg

Range: 0 to 32767 [1]
Default: 32
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Proportional gain for the torque regulator.

528 Ki Torque Reg

Range: 0 to 32767 [1]
Default: 128
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Integral gain for the torque regulator.

529 Torque Reg Trim

Range: 0.5 to 1.5 [0.1]
Default: 1.00
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Torque Regulator Trim gain. A larger value increases the developed torque. Typically used to compensate for losses between developed and shaft torque.

530 Slip Reg Enable

Range: 0 to 1 [1]
Default: 1
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Enables or disables the slip frequency regulator.

531 Kp Slip Reg

Range: 0 to 32767 [1]
Default: 256
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Proportional gain for the slip frequency regulator.

532 Ki Slip Reg

Range: 0 to 32767 [1]
Default: 64
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Integral gain for the slip frequency regulator.

533 Flux Reg Enable

Range: 0 to 1 [1]
Default: 1
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Enables or disables the flux regulator.

534 Kp Flux Reg

Range: 0 to 32767 [1]
Default: 64
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Proportional gain for the flux regulator.

535 Ki Flux Reg

Range: 0 to 32767 [1]
Default: 32
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Integral gain for the flux regulator.

536 Kp Flux Brake

Range: 0 to 32767 [1]
Default: 100
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Proportional gain for the Flux Regulator.

537 Ki Flux Brake

Range: 0 to 32767 [1]
Default: 500
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

Integral gain for the Flux Regulator.

538 Rec Delay Time

Range: 1 to 30000 [1]
Default: 1000
Access: 2 **Path:** Utility>Diag-Motor Cntl
See also:

TBD

539 Ki Freq Reg

Range: 0 to 32767 [1]
Default: 450
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Integral gain for the Frequency Regulator.

540 Kp Freq Reg

Range: 0 to 32767 [1]
Default: 2000
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Proportional gain for the Frequency Regulator.

541 Encdlss Ang Comp

Range: -1023 to 1023 [1]
Default: 0
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Angle used to compensate for long cables attached to inverter and motor. Identified during autotune for Encoderless FVC.

542 Encdlss Vlt Comp

Range: 0 to 115 [1]
Default: 6.1
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Voltage used to compensate for long cables attached to inverter and motor. Identified during autotune for Encoderless FVC.

543 Excitation Ki

Range: 0 to 32767 [1]
Default: 44
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Integral gain for current regulator for excitation of Flying start.

544 Excitation Kp

Range: 0 to 32767 [1]
Default: 1800
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Proportional gain for current regulator for excitation of Flying start.

545 In Phaseloss Lvl

Range: 10 to 1000 [1]
Default: 325
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Input phase loss detection (level).

546 OutPhase LossLvl

Range: 1 to 400 [1]
Default: 200
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Output phase loss detection (level).

547 Ki Fast Brake

Range: 0 to 32767 [1]
Default: 1000
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Integral tuning term for Fast Brake.

548 Kp Fast Brake

Range: 0 to 32767 [1]
Default: 2000
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Proportional tuning term for Fast Brake.

549 Flux Braking %

Range: 100 to 250 % [1%]
Default: 175
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

% of Output voltage applied during Flux braking.

550 Flying Start Ki

Range: 20 to 5000 [1]
Default: 150
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Integral gain for flying start.

551 Ki DC Brake

Range: 0 to 500 [1]
Default: 25
Access: 2 **Path:** Utility>Diag-Vector Cnt
See also:

Integral tuning term for DC Braking.

595 Port Mask Actv

Range: See figure 3.44
Default: Read Only
Access: 2 **Path:** Utility>Security
See also:

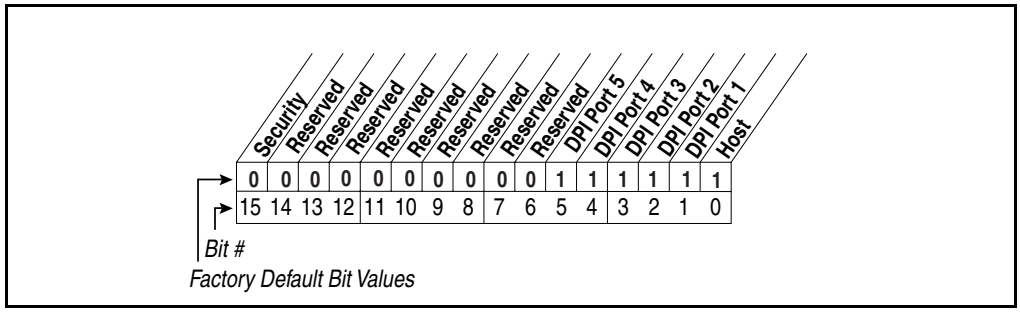


Figure 3.44 – Port Mask Actv

Bits 0-5 indicate status for DPI port communication. Bit 15 indicates when security software is controlling the parameter.

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596 Write Mask Cfg

Range: See figure 3.45
Default: 0 x 3E
Access: 2 **Path:** Utility>Security
See also:

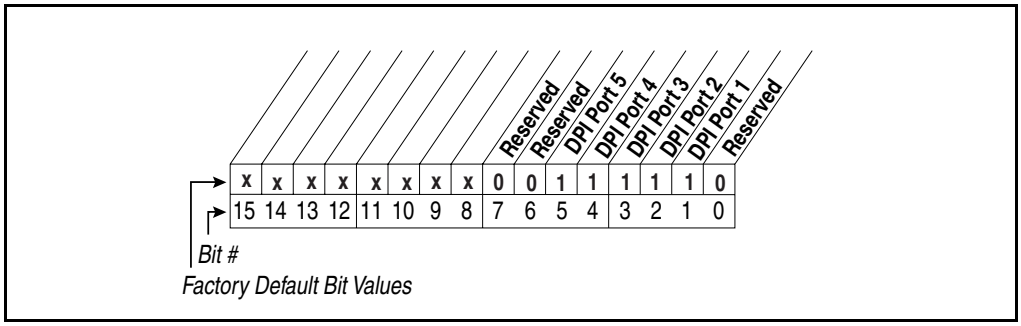

Reserved
Reserved
DPI Port 5
DPI Port 4
DPI Port 3
DPI Port 2
DPI Port 1
Reserved
x x x x x x x x 0 0 1 1 1 1 1 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Bit #
Factory Default Bit Values

Figure 3.45 – Write Mask Cfg

Enables/disables write access (parameters, links, etc.) for DPI ports. Changes to this parameter only become effective when power is cycled, the drive is reset or bit 15 of Write Mask Actv (597) transitions from 1 to 0.

597 Write Mask Actv

Range: See figure 3.46
Default: Read Only
Access: 2 **Path:** Utility>Security
See also:

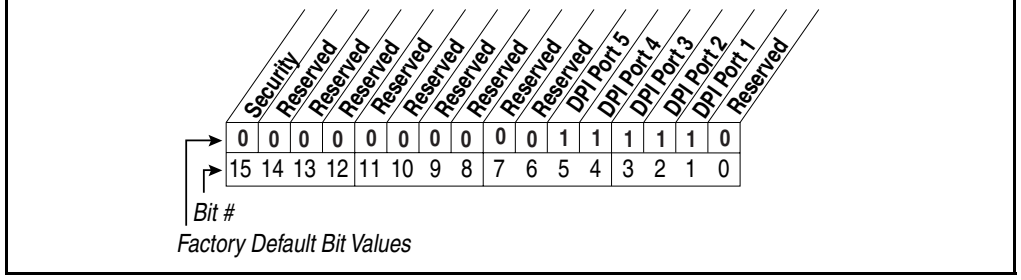


Figure 3.46 – Write Mask Actv

Status of write access for DPI ports. When bit 15 is set, network security is controlling the write mask instead of Write Mask Cfg (596).

598 Logic Mask Actv

Range: See figure 3.47
Default: Read Only
Access: 2 **Path:** Utility>Security
See also:

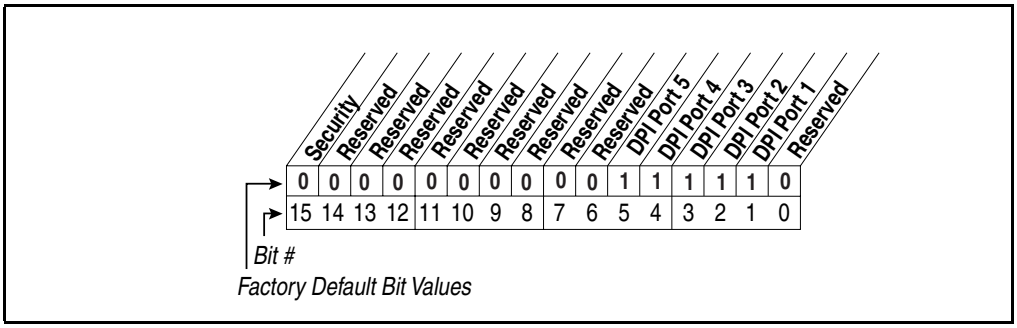


Figure 3.47 – Logic Mask Actv

Indicates status of the logic mask for DPI ports.

CHAPTER 4
Troubleshooting

Chapter 4 provides information to guide you in troubleshooting the Reach Drive. Included is a listing and description of drive faults (with possible solutions, when applicable) and alarms.

Important: You can only troubleshoot the Reach Drive with an HIM or Drive Explorer. Refer to Appendix C for more information.

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

The Reach Drive drive provides the following ways to determine the status of the drive and to troubleshoot problems that may occur:

- User-configurable and non-configurable alarms
- User-configurable and non-configurable faults
- Entries in the fault queue
- Drive status parameters

4.1 About Alarms

Alarms indicate conditions that may affect drive operation or application performance.

Alarms are automatically cleared when the condition that caused the alarm is no longer present.

There are two alarm types, as described in table 4.1.

Table 4.1 – Types of Alarms

Type	Alarm Description	
①	User-Configurable	These alarms alert the operator of conditions that, if left untreated, may lead to a fault condition. The drive continues to operate during the alarm condition. The alarms are enabled or disabled using Alarm Config 1 (259). The status of these alarms is shown in Drive Alarm 1 (211).
②	Non-Configurable	These alarms alert the operator of conditions caused by improper programming and prevent the drive from starting until the problem is resolved. These alarms are always enabled. The status of these alarms is shown in Drive Alarm 2 (212).

The drive indicates alarm conditions in the following ways:

- Alarm name and bell graphic on the LCD HIM. The alarm is displayed as long as the condition exists. The drive automatically clears the alarm when the condition causing it is removed.
- Alarm status parameters. Two 16-bit parameters, Drive Alarm 1 (211) and Drive Alarm 2 (212), indicate the status of type 1 and type 2 alarms, respectively. Refer to chapter 10 for the parameter descriptions.

4.1.1 Alarm Descriptions

Table 4.2 – Alarm Descriptions

<table>
<tr><th>Alarm</th><th>No.</th><th>Type</th><th>Description</th></tr>
<tr><td>Analog In Loss</td><td>5</td><td>①</td><td>An analog input is configured for alarm on signal loss and signal loss has occurred.</td></tr>
<tr><td>Bipolar Conflict</td><td>20</td><td>②</td><td>Parameter 190 (Direction Mode) is set to Bipolar or Reverse Dis and one of more of the following digital input functions is configured: Fwd/Rev, Run Fwd, Run Rev, Jog Fwd, or Jog Rev.</td></tr>
<tr><td>Brake Slipped</td><td>32</td><td>②</td><td>Encoder movement has exceeded the level in BrkSlipCount after the brake was set.</td></tr>
<tr><td>Decel Inhibit</td><td>10</td><td>①</td><td>Drive is being inhibited from decelerating.</td></tr>
<tr><td>Dig In ConflictA</td><td>17</td><td>②</td><td>Digital input functions are in conflict. Combinations marked with a ▲ will cause an alarm.
<table>
<tr><th></th><th>Acc2 / Dec2</th><th>Accel 2</th><th>Decel 2</th><th>Jog</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd / Rev</th></tr>
<tr><td>Acc2 / Dec2</td><td></td><td>▲</td><td>▲</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Accel 2</td><td>▲</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Decel 2</td><td>▲</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog</td><td></td><td></td><td></td><td></td><td>▲</td><td>▲</td><td></td></tr>
<tr><td>Jog Fwd</td><td></td><td></td><td></td><td>▲</td><td></td><td></td><td>▲</td></tr>
<tr><td>Jog Rev</td><td></td><td></td><td></td><td>▲</td><td></td><td></td><td>▲</td></tr>
<tr><td>Fwd / Rev</td><td></td><td></td><td></td><td></td><td>▲</td><td>▲</td><td></td></tr>
</table></td></tr>
<tr><td>Dig In ConflictB</td><td>18</td><td>②</td><td>Digital input functions are in conflict. Combinations marked with a ▲ will cause an alarm.
<table>
<tr><th></th><th>Start</th><th>Stop–CF</th><th>Run</th><th>Run Fwd</th><th>Run Rev</th><th>Jog</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd/ Rev</th></tr>
<tr><td>Start</td><td></td><td></td><td>▲</td><td>▲</td><td>▲</td><td></td><td>▲</td><td>▲</td><td></td></tr>
<tr><td>Stop–CF</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run</td><td>▲</td><td></td><td></td><td>▲</td><td>▲</td><td></td><td>▲</td><td>▲</td><td></td></tr>
<tr><td>Run Fwd</td><td>▲</td><td></td><td>▲</td><td></td><td></td><td>▲</td><td></td><td></td><td>▲</td></tr>
<tr><td>Run Rev</td><td>▲</td><td></td><td>▲</td><td></td><td></td><td>▲</td><td></td><td></td><td>▲</td></tr>
<tr><td>Jog</td><td></td><td></td><td></td><td>▲</td><td>▲</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Fwd</td><td>▲</td><td></td><td>▲</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Rev</td><td>▲</td><td></td><td>▲</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fwd / Rev</td><td></td><td></td><td></td><td>▲</td><td>▲</td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Dig In ConflictC</td><td>19</td><td>②</td><td>More than one physical input has been configured to the same input function. Multiple configurations are not allowed for the following input functions:
Forward/Reverse
Speed Select 1
Speed Select 2
Speed Select 3
Run Forward
Run Reverse
Jog Forward
Jog Reverse
Run
Stop Mode B
Bus Regulation Mode B
Acc2 / Dec2
Accel 2
Decel 2</td></tr>
</table>

Table 4.2 – Alarm Descriptions (Continued)

Alarm	No.	Type	Description
Drive OL Level 1	8	①	The calculated IGBT temperature requires a reduction in PWM carrier frequency. If Drive OL Mode (150) is disabled and the load is not reduced, an overload fault will eventually occur.
Drive OL Level 2	9	①	The calculated IGBT temperature requires a reduction in Current Limit. If Drive OL Mode (150) is disabled and the load is not reduced, an overload fault will eventually occur.
Flux Amps Ref Rang	26	②	The calculated or measured Flux Amps value is not within the expected range. Verify motor data and rerun motor tests.
Ground Warn	15	①	Ground current has exceeded the level set in Gnd Warn Level (177).
Home Not Set	34	①	Configurable alarm set in parameter 259, bit 17. When set to “1”, this alarm is displayed when any of the following occur: • parameter 88 is set to “7” (Pos/Spd Prof) • on power up and parameter 88 = “7” • recall user sets and parameter 88 = “7” Alarm is cleared when: • setting parameter 88 to a value other than “7” • reset defaults • parameter 259, bit 17 is cleared • a digital input is configured as “Set Home” and input is True • parameter 705, bit 9 is “Enabled” • parameter 700, bit 13 (At Home) is “Enabled” - position regulator will set this bit if device is “home”
In Phase Loss	13	①	The DC bus ripple has exceeded the level set in Phase Loss Level (545).
IntDBRes OvrHeat	6	①	The drive has temporarily disabled the dynamic braking regulator because the resistor temperature has exceeded a predetermined value.
IR Volts Range	25	②	The drive autotuning default is Calculate and the value calculated for IR Drop Volts is not in the range of acceptable values. This alarm should clear when all motor nameplate data is properly entered.
Ixo Vlt Rang	28	②	Motor leakage inductance is out of range.
Load Loss	14		Output torque current is below Load Loss Level (187) for a time period greater than Load Loss Time (188).
MaxFreq Conflict	23	②	The sum of Maximum Speed (82) and Overspeed Limit (83) exceeds Maximum Freq (55). Raise Maximum Freq (55) or lower Maximum Speed (82) and/or Overspeed Limit (83) so that the sum is less than or equal to Maximum Freq (55).
Motor Thermistor	12		The value at the thermistor terminals have been exceeded.

Table 4.2 – Alarm Descriptions (Continued)

Alarm	No.	Type	Description
Motor Type Cflct	21	②	Motor Type (90) has been set to Sync PM or Sync Reluc, and one or more of the following exist: • Torque Perf Mode = “Sensrls Vect,” “SV Economizer” or “Fan/Pmp V/Hz.” • Flux Up Time is greater than 0.0 secs. • Speed Mode is set to “Slip Comp.” • Autotune = “Static Tune” or “Rotate Tune.”
NP Hz Conflict	22	②	Fan/pump mode is selected in Torq Perf Mode (53), and the ratio of Motor NP Hertz (43) to Maximum Freq (55) is greater than 26.
Power Loss	3	①	Drive has sensed a power line loss.
Precharge Active	1	①	Drive is in the initial DC bus precharge state.
Prof Step Cflct	50	②	An error is detected in trend step(s). • Set if Sleep mode is enabled • Set if: • any profile step uses “Encoder Incr” and/or “Enc Absolute” **and** Motor Cntl Sel (53) is **not** set to “FVC Vector” **and** Feedback Select (80) is **not** set to “Encoder” or “Simulator” **and** Speed/Torque Mod (88) = “7” (Pos/Spd Prof). • a Step Type is configured for “Dig Input” and the Step Value is greater than 6, less than -6, or zero **or** the digital input selected with Digital Inx Sel is **not** set to “57” (Prof Input). • Cleared if none of the above occur.
PTC Conflict	31	②	PTC is enabled for Analog In 1, which is configured as a 0-20 mA current source in Anlg In Config (320).
Sleep Config	29	②	Sleep/Wake configuration error. With Sleep-Wake Mode (178) = Direct, possible causes include: drive is stopped and Wake Level < Sleep Level. “Stop=CF”, “Run,” “Run Forward” and “Run Reverse” is not configured in Digital Inx Sel.
Speed Ref Cflct	27	②	Speed Ref x Sel or PI Reference Sel is set to “Reserved.”
Start At Powerup	4	①	Start At Powerup (168) is enabled. Drive may start at any time within 10 seconds of drive powerup.

Table 4.2 – Alarm Descriptions (Continued)

Alarm	No.	Type	Description
TB Man Ref Cflct	30	②	Occurs when: • "Auto/Manual" is selected (default) for Digital In3 Sel (363) and • TB Man Ref Sel (96) has been reprogrammed. No other use for the selected analog input may be programmed. Example: If TB Man Ref Sel is reprogrammed to "Analog In 2," all of the factory default uses for "Analog In 2" must be reprogrammed. To correct: • Verify/reprogram the parameters that reference an analog input or • Reprogram Digital In3 to another function or "Unused."
TorqProve Cflct	49	②	When TorqProve Cnfg is enabled, Motor CntlSel, Feedback Select, and Motor Fdbk Type must be properly set.
Under-Voltage	2	①	The bus voltage has dropped below a predetermined value.
VHz Neg Slope	24	②	Custom V/Hz mode has been selected in Torq Perf Mode (53) and the V/Hz slope is negative.
Waking	11	①	The Wake timer is counting toward a value that will start the drive.

Table 4.3 – Alarm Names Cross-Referenced by Alarm Numbers

No.[1]	Alarm	No.[1]	Alarm	No.[1]	Alarm
1	Precharge Active	13	In Phase Loss	25	IR Volts Range
2	UnderVoltage	14	Load Loss	26	FluxAmps Ref Rang
3	Power Loss	15	Ground Warn	27	Speed Ref Cflct
4	Start At PowerUp	17	Dig In ConflictA	28	Ixo Vlt Rang
5	Analog In Loss	18	Dig In ConflictB	29	Sleep Config
6	IntDBRes OvrHeat	19	Dig In ConflictC	30	TB Man Ref Cflct
8	Drive OL Level 1	20	Bipolar Conflict	31	PTC Conflict
9	Drive OL Level 2	21	Motor Type Conflict	32	Brake Slipped
10	Decel Inhibit	22	NP Hz Conflict	34	Home Not Set
11	Waking	23	MaxFreq Conflict	49	Torq Prove Cflct
12	Motor Thermistor	24	VHz Neg Slope	50	Prof Step Cflct

1.Alarm numbers not listed are reserved for future use.

4.2 About Faults

Faults indicate conditions within the drive that require immediate attention. The drive responds to a fault by initiating a coast-to-stop sequence and turning off output power to the motor.

In addition, some faults are auto-resettable, non-resettable, and/or user-configurable as described in table 4.4.

Table 4.4 – Fault Types

Type	Fault Description	
①	Auto-Reset/Run	If the drive is running when this type of fault occurs, and Auto Rstrt Tries (174) is set to a value greater than 0, a user-configurable timer, Auto Rstrt Delay (175) begins. When the timer reaches zero, the drive attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault will be reset and the drive will be restarted.
②	Non-Resettable	This type of fault normally requires drive or motor repair. The cause of the fault must be corrected before the fault can be cleared. The fault will be reset on power up after repair.
③	User-Configurable	These faults can be enabled/disabled to either annunciate or ignore a fault condition using Fault Config 1 (238).

The drive indicates faults in the following ways:

- Drive status parameters Drive Status 1 (209) and Drive Status 2 (210).
- Entries in the fault queue (see section 4.2.1).
- Pop-up screen on the LCD HIM. The screen displays:
  - Fault number
  - Fault name
  - Time that has elapsed since fault occurred.

4.2.1 About the Fault Queue

The drive automatically retains a history of faults that have occurred in the fault queue. The fault queue is accessed using the HIM or DriveExplorer Pro software.

The fault queue holds the 16 most recent faults. The last fault to occur is indicated in queue entry #1. As new faults are logged into the queue, existing fault entries are shifted (for example, entry #1 will move to entry #2). Once the queue is full, older faults are discarded from the queue as new faults occur.

All entries in the fault queue are retained if power is lost.

The Time Stamp

For each entry in the fault queue, the system also displays a fault code and time stamp value. The time stamp value is the value of an internal drive-under-power timer at the

time of the fault. The value of this timer is copied to PowerUp Marker (242) when the drive powers up. The fault queue time stamp can then be compared to the value in PowerUp Marker to determine when the fault occurred relative to the last drive power up.

The time stamp is cleared when the fault queue is cleared.

4.2.2 Clearing Faults

A fault condition can be cleared by the following:

Step 1. Press ESC PROG to acknowledge the fault and remove the fault pop-up from the LCD HIM screen.

Step 2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared.

Step 3. After corrective action has been taken, clear the fault using one of the following:

- Setting Fault Clear (240) to Clear Faults (1).
- Issuing a Stop-Clear Faults command from the control source.

Resetting faults will clear the faulted status indication. If any fault condition still exists, the fault will be latched, and another entry made in the fault queue.

Note that performing a fault reset does not clear the fault queue. Clearing the fault queue is a separate action. See the Fault Clear (240) parameter description.

4.2.3 Fault Descriptions and Corrective Actions

Table 4.5 describes drive faults and corrective actions. It also indicates if the fault is

① Auto-resettable

② Non-resettable

③ User-configurable

Table 4.5 – Fault Descriptions and Corrective Actions

Fault	No.	Type	Description	Action
Analog In Loss	29	① ③	An analog input is configured to fault on signal loss. A signal loss has occurred. Configure with Anlg In 1, 2 Loss (324, 327).	1. Check parameters. 2. Check for broken/loose connections at inputs.
Anlg Cal Chksum	108		The checksum read from the analog calibration data does not match the checksum calculated.	Replace drive.
Auto Rstrt Tries	33	③	Drive unsuccessfully attempted to reset a fault and resume running for the programmed number of Auto Rstrt Tries (174). Enable/disable with Fault Config 1 (238).	Correct the cause of the fault and manually clear.
AutoTune Aborted	80		The autotune procedure was canceled by the user or a fault occurred.	Restart procedure.
Auxiliary Input	2	①	Input is open.	Check remote wiring.
Cntl Bd Overtemp	55		The temperature sensor on the Main Control Board detected excessive heat.	1. Check Main Control Board fan. 2. Check surrounding air temperature. 3. Verify proper mounting/cooling.
DB Resistance	69		Resistance of the internal DB resistor is out of range.	Replace resistor.
Decel Inhibit	24	③	The drive is not following a commanded deceleration because it is attempting to limit bus voltage.	1. Verify input voltage is within drive specified limits. 2. Verify system ground impedance follows proper grounding techniques. 3. Disable bus regulation and/or add dynamic brake resistor and/or extend deceleration time.

Table 4.5 – Fault Descriptions and Corrective Actions (Continued)

Fault	No.	Type	Description	Action
Drive OverLoad	64		Drive rating of 110% for 1 minute or 150% for 3 seconds has been exceeded.	Reduce load or extend Accel Time (140).
Drive Powerup	49		No fault displayed. Used as a Power Up Marker in the Fault Queue indicating that the drive power has been cycled.	
Excessive Load	79		Motor did not come up to speed in the allotted time.	1. Uncouple load from motor. 2. Repeat Autotune (61).
Encoder Loss	91		Required differential encoder. One of the 2 encoder channel signals is missing.	1. Check wiring. 2. Replace encoder.
Encoder Quad Err	90		Both encoder channels changed state within one clock cycle.	1. Check for externally induced noise. 2. Replace encoder.
Faults Cleared	52		No fault displayed. Used as a marker in the Fault Queue indicating that the fault clear function was performed.	
Flt QueueCleared	51		No fault displayed. Used as a marker in the Fault Queue indicating that the clear queue function was performed.	
FluxAmpsRef Rang	78		The value for flux amps determined by the autotune procedure exceeds the programmed Motor NP FLA (42).	1. Reprogram Motor NP FLA (42) with the correct motor nameplate value. 2. Repeat Autotune (61).
Ground Fault	13	①	A current path to Earth ground greater than 25% of drive rating.	Check the motor and external wiring to the drive output terminals for a grounded condition.
Hardware Fault	93		Hardware enable is disabled (jumpered high) but logic pin is still low.	1. Check jumper. 2. Replace Main Control Board.
Hardware Fault	130		Gate array load error.	1. Cycle power. 2. Replace Main Control Board.
Hardware Fault	131		Dual port failure.	1. Cycle power. 2. Replace Main Control Board.
Hardware PTC	18		Motor PTC (positive temperature coefficient) sensor overtemp	1. Verify proper PTC connection. 2. Motor is overheated; reduce load.
Heatsink OvrTemp	8	①	Heatsink temperature exceeds 100% of Drive Temp.	1. Verify that maximum ambient temperature has not been exceeded. 2. Check fan. 3. Check for excess load.

Table 4.5 – Fault Descriptions and Corrective Actions (Continued)

Fault	No.	Type	Description	Action
HW OverCurrent	12	①	The drive output current has exceeded the hardware current limit.	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
I/O Comm Loss	121	②	I/O Board lost communication with the Main Control Board.	1. Check connector. 2. Check for induced noise. 3. Replace I/O board of Main Control Board.
I/O Failure	122		I/O was detected, but failed the powerup sequence.	Replace Main Control Board.
I/O Board Mismatch	120		Incorrect I/O board identified.	Restore I/O board to original configuration, or If new configuration is desired, reset fault.
Incompat MCB-PB	106	②	Drive rating information stored on the power board is incompatible with the Main Control board.	Load compatible version files into drive.
Input Phase Loss	17		The DC bus ripple has exceed a preset level.	Checking incoming power for a missing phase/blown fuse.
IR Volts Range	77		The drive autotuning default is Calculate, and the value calculated for IR Drop Volts is not in the range of acceptable values.	Re-enter motor nameplate data.
IXo VoltageRange	87		Voltage calculated for motor inductive impedance exceeds 25% of Motor NP Volts (41).	1. Check for proper motor sizing. 2. Check for correct programming of Motor NP Volts (41). 3. Additional output impedance may be required.
Load Loss	15		Drive output torque current is below Load Loss Level for a time greater than Load Loss Time.	1. Verify connections between motor and load. 2. Verify level and time requirements.
Motor Overload	7	① ③	Internal electronic overload trip. Enable/disable with Fault Config 1 (238).	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by Motor NP FLA (42).
Motor Thermistor	16		Thermistor output is out of range.	1. Verify that thermistor is connected. 2. Motor is overheated. Reduce load.

Table 4.5 – Fault Descriptions and Corrective Actions (Continued)

Fault	No.	Type	Description	Action
NVS I/O Checksum	109		EEprom checksum error.	1. Cycle power and repeat function. 2. Replace Main Control Board.
NVS I/O Failure	110		EEprom I/O error.	1. Cycle power and repeat function. 2. Replace Main Control Board.
Output Phase Loss	21		Current in one or more phases has been lost or remains below a preset level.	Check the drive and motor wiring. Check for phase-to-phase continuity at the motor terminals. Check for disconnected motor leads.
OverSpeed Limit	25	①	Functions such as slip compensation or bus regulation have attempted to add an output frequency adjustment greater than that programmed in Overspeed Limit (83).	Remove excessive load or overhauling conditions or increase Overspeed Limit (83).
OverVoltage	5	①	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.
Parameter Chksum	100	②	The checksum read from the board does not match the checksum calculated.	1. Restore defaults. 2. Reload user set if used.
Params Defaulted	48		The drive was commanded to write default values to EEPROM.	1. Clear the fault or cycle power to the drive. 2. Program the drive parameters as needed.
Phase U to Grnd	38		A phase-to-ground fault has been detected between the drive and motor in this phase.	1. Check the wiring between the drive and motor. 2. Check motor for grounded phase. 3. Replace drive.
Phase V to Grnd	39			
Phase W to Grnd	40			
Phase UV Short	41		Excessive current has been detected between these two output terminals.	1. Check the motor and drive output terminal wiring for a shorted condition. 2. Replace drive.
Phase VW Short	42			
Phase UW Short	43			

Table 4.5 – Fault Descriptions and Corrective Actions (Continued)

Fault	No.	Type	Description	Action
Port 1-5 DPI Loss	81-85		DPI port stopped communicating. An attached peripheral with control capabilities via Logic Source Sel (89) (or HIM control) was removed. The fault code indicates the offending port number (81 = port 1, etc.)	1. If module was not intentionally disconnected, check wiring to the port. Replace wiring, port expander, modules, Main Control board or complete drive as required. 2. Check HIM connection.
Port 1-5 Adapter	71-75		The communications card has a fault.	Check the DPI device event queue and corresponding fault information for the device.
Power Loss	3	① ③	DC bus voltage remained below 85% of nominal for longer than Power Loss Time (185). Enable/disable with Fault Config 1 (238).	Monitor the incoming AC line for low voltage or line power interruption.
Power Unit	70		One or more of the output transistors were operating in the active region instead of desaturation. This can be caused by excessive transistor current or insufficient base drive voltage.	1. Check for damaged output transistors. 2. Replace drive.
Pulse In Loss	92		Z channel is selected as a pulse input and no signal is present.	1. Check wiring. 2. Replace pulse generator.
Pwr Brd Chksum1	104		The checksum read from the EEPROM does not match the checksum calculated from the EEPROM data.	Clear the fault or cycle power to the drive.
Pwr Brd Chksum2	105	②	The checksum read from the board does not match the checksum calculated.	1. Cycle power to the drive. 2. If problem persists, replace drive.
Replaced MCB-PB	107	②	Main Control Board was replaced and parameters were not programmed.	1. Restore defaults. 2. Reprogram parameters.
See Manual	28		Encoderless Torque Proving has been enabled but user has not read and understood application concerns of encoderless operation.	1. Read the attention on page 13-6 relating to the use of Torque Proving with no encoder.
Shear Pin	63	③	Programmed Current Lmt Val (148) has been exceeded. Enabled/disable with Fault Config 1 (238).	Check load requirements and Current Lmt Val (148) setting.
Software Fault	88		Microprocessor handshake error.	Replace Main Control Board.

Table 4.5 – Fault Descriptions and Corrective Actions (Continued)

Fault	No.	Type	Description	Action
Software Fault	89		Microprocessor handshake error.	Replace Main Control Board.
SW OverCurrent	36	①	The drive output current has exceeded the software current.	Check for excess load, improper DC boost setting. DC brake volts set too high.
TorqProv Spd Band	20		Difference between Commanded Speed and Encoder Speed has exceeded the level set in Spd Dev Band for a time period greater than Spd Band Integrat.	1. Check wiring between drive and motor. 2. Check release of mechanical brake.
Trnsistr OvrTemp	9	①	Output transistors have exceeded their maximum operating temperature.	Check for proper temperature and flow rate of coolant.
UnderVoltage	4	① ③	DC bus voltage fell below the minimum value of 407V DC at 400/480V input or 204V DC at 200/240V input. Enable/disable with Fault Config 1(233).	Monitor the incoming AC line for low voltage or power interruption.
UserSet1 Chksum	101	②	The checksum read from the user set does not match the checksum calculated.	Re-save user set.
UserSet2 Chksum	102	②		
UserSet3 Chksum	103	②		

Table 4.6 – Fault Names Cross-Referenced by Fault Number

No.[1]	Fault
2	Auxiliary Input
3	Power Loss
4	UnderVoltage
5	OverVoltage
7	Motor Overload
8	Heatsink OvrTemp
9	Trnsistr OvrTemp
12	HW OverCurrent
13	Ground Fault
15	Load Loss
16	Motor Thermistor
17	Input Phase Loss
18	Hardware PTC
20	TorqProv Spd Band
21	Output Phase Loss
24	Decel Inhibit
25	OverSpeed Limit
28	See Manual

No.[1]	Fault
29	Analog In Loss
39	Phase V to Grnd
40	Phase W to Grnd
41	Phase UV Short
42	Phase VW Short
43	Phase UW Short
48	Params Defaulted
49	Drive PowerUp
51	Flt QueueCleared
52	Faults Cleared
55	Cntl Bd OverLoad
63	Shear Pin
64	Drive OverLoad
69	DB Resistance
70	Power Unit
71- 75	Port 1-5 Net Loss
77	IR Volts Range
78	FluxAmpsRef Rang

No[1]	Fault
87	IXo VoltageRange
88	Software Fault
89	Software Fault
90	Encoder Quad Err
91	Encoder Loss
92	Pulse In Loss
93	Hardware Fault
100	Parameter Chksum
101-103	UserSetX Chksum
104	Pwr Brd Chksum1
105	Pwr Brd Chksum2
106	Incompat MCB-PB
107	Replaced MCB-PB
108	Anlg Cal Chksum
120	I/O Mismatch
121	I/O Comm Loss
122	I/O Failure
130	Hardware Fault

Table 4.6 – Fault Names Cross-Referenced by Fault Number

No.[1]	Fault	No.[1]	Fault	No[1]	Fault
33	Auto Rstrt Tries	79	Excessive Load	131	Hardware Fault
36	SW OverCurrent	80	AutoTune Aborted		
38	Phase U to Grnd	81- 85	Port 1-5 DPI Loss		

1. Fault numbers not listed are reserved for future use.

4.3 Testpoint Parameter

Select testpoint with Testpoint X Sel (234, 236). Values can be viewed with Testpoint X Data (235, 237).

Table 4.7 – Test Point Codes and Functions

Number[1]	Description	Default
01	DPI Error Status	0
02	Heatsink Temp	0
03	Active Cur Limit	0
04	Active PWM Freq	4
05	Lifetime MegaWatt Hours[2]	0
06	Life Run Time	0
07	Life Pwr Up Time	0
08	Life Pwr Cycles	0
09	Life MW-HR Fract [2]	0
10	MW-HR Fract Unit [2]	0
11	MCN Life Time	0
12	Raw Analog In 1	0
13	Raw Analog In 2	0
16	CS Msg Rx Cnt	0
17	CS Msg Tx Cnt	0
18	CS Timeout Cnt	0
19	CS Msg Bad Cnt	0
22	PC Msg Rx Cnt	0
23	PC Msg Tx Cnt	0
24-29	PC1-6 Timeout Cnt	0
30	CAN BusOff Cnt	0
31	No. of Analog Inputs	0
32	Raw Temperature	0
33	MTO Norm Mtr Amp	0
34	DTO-Cmd Frequency	0
35	DTP-Cmd Cur Lim	0
36	DTO-Cmd DC Hold	0
37	Control Bd Temp	0.0

1. Enter in Testpoint x Sel.
2. Use the equation below to calculate total Lifetime MegaWatt Hours.

$$\left(\frac{\text{Value of Code 9}}{\text{Value of Code 10}} \times 0.1\right) + \text{Value of Code 5} = \text{Total Lifetime Megawatt Hours}$$

4.4 Troubleshooting the Drive Using the LCD HIM

The LCD HIM provides immediate visual notification of alarm or fault conditions as well as the following diagnostic information:

- Entries in the fault queue
- Fault parameters
- Drive status parameters
- Selected device version and status information
- HIM version information

4.4.1 Accessing the Fault Queue

As described in section 4.2.1, the drive automatically retains a history of the last 16 faults that have occurred in the fault queue.

To access the fault queue, press FAULT ALARM or select Faults>View Fault Queue from the Diagnostics Menu off of the main screen.

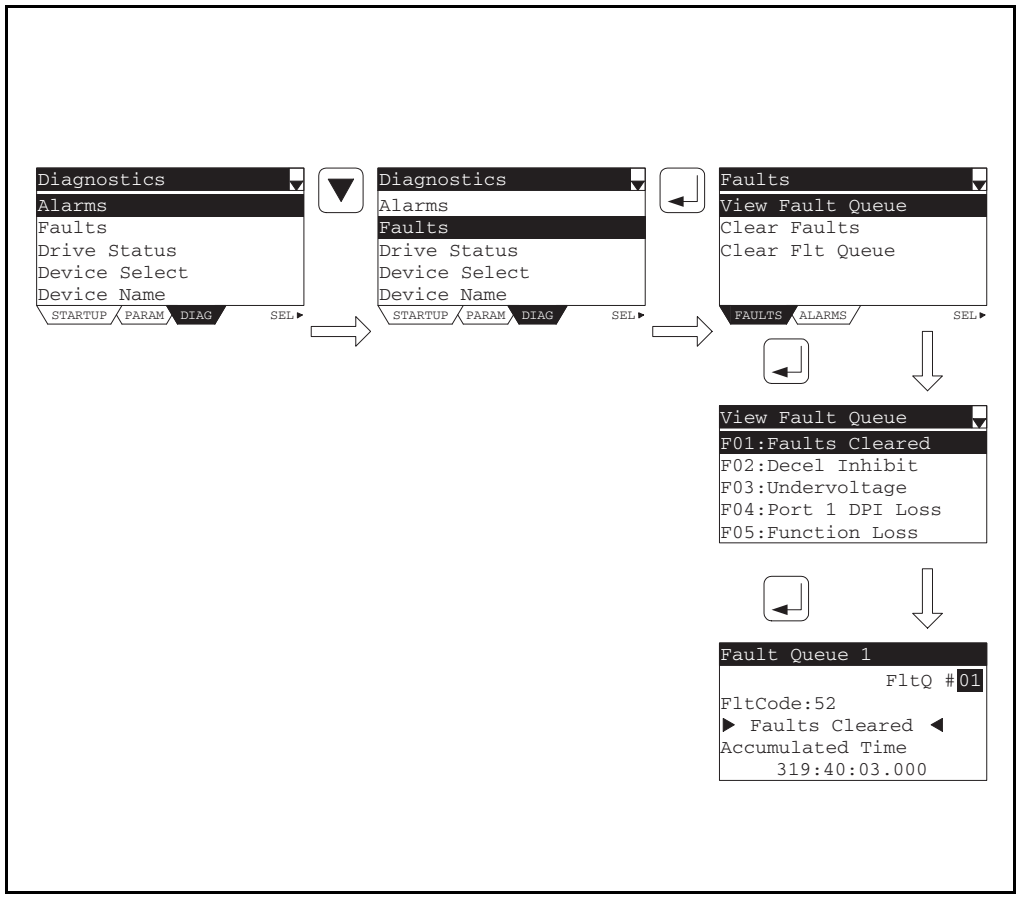


Figure 4.1 – Accessing the Fault Queue

APPENDIX A

Technical Specifications

Table A.1 – Drive Monitoring and Limits

All Drives	
Heat Sink Thermistor	Monitored by microprocessor overtemp trip
Drive Overcurrent Trip Software Current Limit Hardware Current Limit	 200% of rated current (typical) 220-300% of rated current (Depending on drive rating)
Line Transients	up to 6000 volts peak per IEEE C62.41-1991
Control Logic Noise Immunity	Showering arc transients up to 1500V peak
Power Ride-Thru	15 milliseconds at full load
Logic Control Ride-Thru	0.5 seconds minimum, 2 seconds typical
Ground Fault Trip	Phase-to-ground on drive output
Short Circuit Trip	Phase-to-phase on drive output
Intermittent Overload	110% overload capability for up to 1 minute. 150% overload capability for up to 3 seconds.
Current Limit Capability	Proactive Current Limit programmable from 20 to 160% of rated output current. Independently programmable proportional and integral gain.
Electronic Motor Overload Protection	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.

Table A.2 – Certifications

The drive is designed to meet the following specifications: NFPA 70 - US National Electrical Code NEMA ICS 3.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems. IEC 146 - International Electrical Code.

Table A.3 – Environment

Altitude	1000 m (3300 ft) max. without derating
Ambient Operating Temperature without derating: IP20, NEMA 1	–10 to 60° C (14 to 140° F)
Storage Temperature (all const.)	–40 to 70° C (–40 to 158° F)
Atmosphere	**Important:** Drive **must not** be installed in an area where the ambient temperature contains volatile or corrosive gas, vapors, or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.
Relative Humidity	5 to 95% non-condensing
Shock	40G peak for 6ms duration (±3.0 ms)
Vibration	**Sinusoidal:** 0.35mm constant displacement to a constant acceleration of 5G. 10-500 Hz 1 octave/min 10 sweep cycles 3 axis **Random:** $0.05g^2$/Hz 10 Hz to 500 Hz 3 axes at 30 minutes/axis

Table A.4 – Input Specifications

Input Voltage	480 V RMS +10% -15% (Operate to -50% with reduced power, -30% minimum for precharge) **Note:** The Reach Drive requires a 3% input impedance.
Input Frequency Range	47 to 63 Hz
Line to Neutral Phase Imbalance Tolerance	2%

Table A.5 – Control Specifications

Method	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives. The drive can be supplied as 6-pulse or 12-pulse in a configured package.
Carrier Frequency	2-10 kHz. Drive rating based on 4 kHz
Output Voltage Range	0 to rated motor voltage
Output Frequency Range	0 to 420 Hz.
Frequency Accuracy Digital Input Analog Input	 Within ±0.01% of set output frequency Within ±0.4% of maximum output frequency

Table A.5 – Control Specifications

Frequency Control	Speed Regulation - with Slip Compensation (Volts per Hertz Mode) 0.5% of base speed across 40:1 speed range 40:1 operating range 10 rad/sec bandwidth
	Speed Regulation - with Slip Compensation (Sensorless Vector Mode) 0.5% of base speed across 80:1 speed range 80:1 operating range 20 rad/sec bandwidth
	Speed Regulation - with Feedback (Sensorless Vector Mode) 0.1% of base speed across 80:1 speed range 80:1 operating range 20 rad/sec bandwidth
Speed Control	Speed Regulation - without Feedback (Vector Control Mode) 0.1% of base speed across 120:1 speed range 120:1 operating range 50 rad/sec bandwidth
	Speed Regulation - with Feedback (Vector Control Mode) 0.001% of base speed across 120:1 speed range 1000:1 operating range 250 rad/sec bandwidth
Torque Regulation	Torque Regulation - without Feedback +/- 5%, 600 rad/sec bandwidth
	Torque Regulation - with Feedback +/- 2%, 2500 rad/sec bandwidth
Selectable Motor Control	Sensorless Vector with full tuning. Standard V/Hz with full custom capability.
Stop Modes	Multiple programmable stop modes including Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.
Accel/Decel	Two independently programmable accel and decel times. Each time may be programmed from 0 - 3600 seconds in 0.1 second increments.

Table A.6 – Liquid Coolant

Coolant Type	50% / 50% Water/Propolyne Glycol
Maximum Particle Size in Coolant	5 microns
Minimum Flow Rate	2 gpm
Nominal Flow Rate	2.5 gpm
Maximum Flow Rate	6 gpm
Pressure Drop	<5 psi at 2.5 gpm, 20° C
Maximum Coolant Temperature	60° C
Maximum Inlet Pressure	50 psi

Table A.7 – Output Specifications

Output Voltage	0 to 460 V RMS at nominal 480 V RMS input. Output will be 460 V RMS
Output Frequency Range	0 to 420 Hz
Switching Frequency	4 kHz Base. 2, 4, 8, 10 KHz selectable with derating. Derating at 8 and 10 KHz.
Continuous Output Power	100 KW (150 HP)
Continuous Output Current	180 Amps RMS
Peak Output Current (3 sec maximum)	270 Amps RMS (3 sec / 60 sec)
Peak Output Current (60 sec)	198 Amps RMS (1 min / 10 min)
Efficiency at Maximum Power, Nominal Voltage	>97.5%
Power Loss at Full Load	1900 W at 100 KW
Power Loss to Air	200 W at 110 KW

Table A.8 – Encoder

Type	Incremental, dual channel
Supply	12V, 250mA. 12V,10mA minimum inputs isolated with differential transmitter, 250 kHz maximum
Quadrature	90° , +/- 27 degrees at 25° C
Duty Cycle	50%, +10%
Requirements	Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), 8-15VDC output, single-ended or differential and capable of supplying a minimum of 10mA per channel. Maximum input frequency is 250 kHz. The Encoder Interface Board accepts 12VDC square-wave with a minimum high state voltage of 7.0VDC (12 volt encoder). Maximum low state voltage is 0.4VDC.

Table A.9 – Dynamic Brake Resistor

Regen DC Bus Voltage (V_d)	790 Volts
Minimum Ohms, External Brake Resistor	11.0 Ohms

Table A.10 – Auxillary Power Supplies

24 V	3 isolated supplies at 0.025 A 1 isolated supply at 0.075 A 1 supply at 0.8 A **(24 V +/- 10%)**
15 V	1 isolated supply at 0.1 A **(15 V +/- 10%)**
+12 V	1 supply at 0.6 A **(+12 V +/- 10%)**
-12 V	1 supply at 0.2 A **(-12 +/- 10%)**
5 V	1 supply at 2.0 A **(5V +/- 10%)**

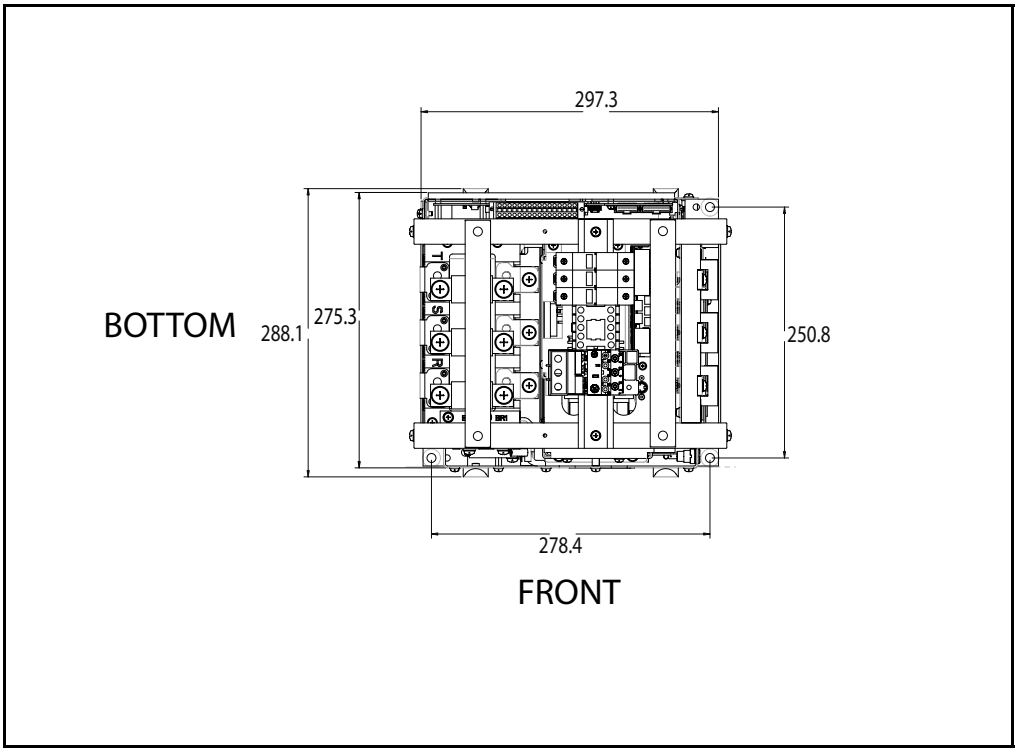


Figure A.1 – Dimensions (Front View)

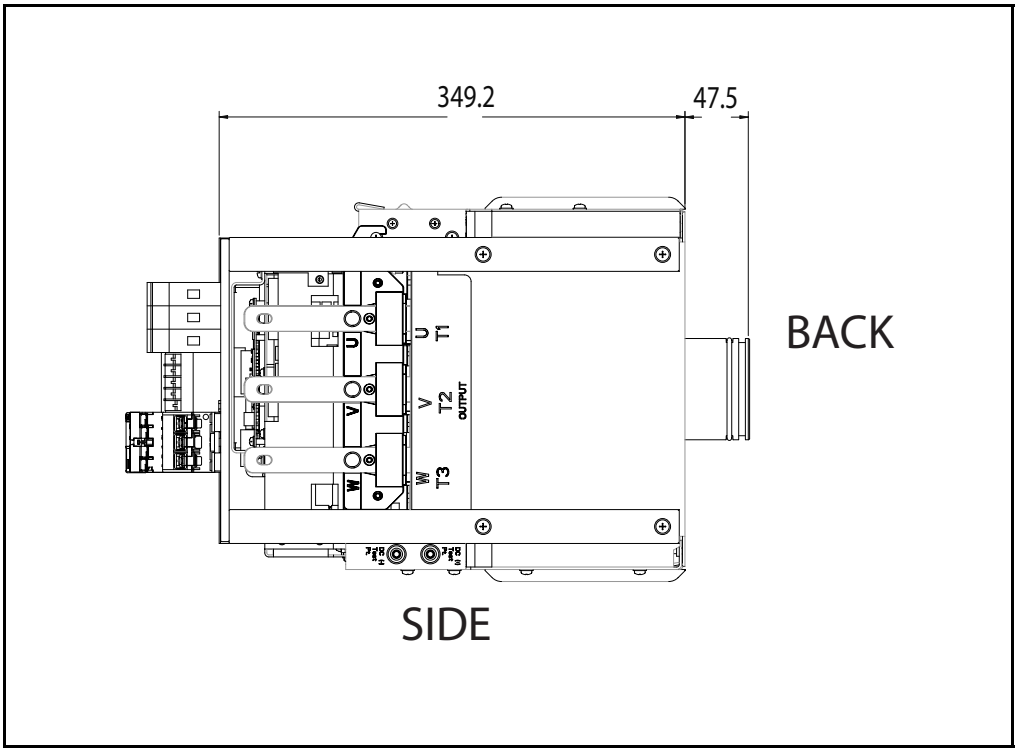


Figure A.2 – Dimensions (Side View)

APPENDIX B

Logic Command/Status Words

Appendix B provides information on Logic Command and Logic Status Words.

Important: If block transfers are programmed to continuously write information to the drive, care must be taken to properly format the block transfer. If attribute 10 is selected for the block transfer, values will be written only to RAM and will not be saved by the drive. This is the preferred attribute for continuous tranfers. If attribute 9 is selected, each program scan will complete a write to the drives non-volatile memory (EEprom). Since the EEprom has a fixed number of allowed writes, continuous block transfers will quickly damage the EEprom. Do not assign attribute 9 to continuous block transfers.

B.1 Logic Command Words

Logic Bits															Command	Description
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Stop[1]	0 = Not Stop 1 = Stop
														X		Start [1,2]	0 = Not Start 1 = Start
													X			Jog	0 = Not Jog 1 = Jog
												X				Clear Faults	0 = Not Clear Faults 1 = Clear Faults
										X	X					Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Present Direction
									X							Local Control	0 = No Local Control 1 = Local Control
								X								MOP Increment	0 = Not Increment 1 = Increment
						X	X									Accel Rate	00 = No Command 01 = Use Accel Time 1 10 = Use Accel Time 2 11 = Use Present Time
				X	X											Decel Rate	00 = No Command 01 = Use Accel Time 1 10 = Use Accel Time 2 11 = Use Present Time
	X	X	X													Reference Select[3]	000 = No Command 001 = Ref. 1 (Ref A Select) 010 = Ref. 2 (Ref B Select) 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
X																MOP Decrement	0 = Not Decrement 1 = Decrement

[1]A “0 = Not Stop” condition (logic 0) must first be present before a “1 = Start” condition will start the drive. The start command acts as a momentary Start command. A “1” will start the drive, but returning to “0” will not stop the drive.

[2]This start will not function if a digital input (parameters 361-366) is programmed for a 2-wire control (option 7, 8, or 9).

[3]This Reference Select will not function if a digital input (parameters 361-366) is programmed for “Speed Sel 1, 2, or 3” (option 15, 16, or 17).

B.2 Logic Status Word

Logic Bits															Command	Description
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Ready	0 = Not Ready 1 = Ready
														X		Active	0 = Not Active 1 = Active
													X			Command Direction	0 = Reverse 1 = Forward
												X				Actual Direction	0 = Reverse 1 = Forward
											X					Accel	0 = Not Accelerating 1 = Accelerating
										X						Decel	0 = Not Decelerating 1 = Decelerating
									X							Alarm	0 = No Alarm 1 = Alarm
								X								Fault	0 = No Fault 1 = Fault
							X									At Speed	0 = Not at Reference 1 = At Reference
				X	X	X										Local Control	000 = Port 0 (TB) 001 = Port 1 010 = Port 2 011 = Port 3 100 = Port 4 101 = Port 5 110 = Reserved 111 = No Local
X	X	X	X													Reference Source	0000 = Ref A Auto 0001 = Ref B Auto 0010 = Preset 2 Auto 0011 = Preset 3 Auto 0100 = Preset 4 Auto 0101 = Preset 5 Auto 0110 = Preset 6 Auto 0111 = Preset 7 Auto 1000 = Term Blk Manual 1001 = DPI 1 Manual 1010 = DPI 2 Manual 1011 = DPI 3 Manual 1100 = DPI 4 Manual 1101 = DPI 5 Manual 1110 = Reserved 1111 = Jog Ref

APPENDIX C

HIM Overview

Reach Drive HIM Model Numbers

Table A.1 – NEMA 1 HIM Model Numbers

Model Number	Description
20-HIM-A3	LCD Full Numeric Keypad
20-HIM-A5	LCD Programmer Only

Table A.2 – NEMA 4 HIM Model Numers

Model Number	Description
20-HIM-C3S	Remote Panel Mount; Full Numeric Keypad; Small Footprint (Typically used for upgrading from the NEMA 1 HIM Bezel)
20-HIM-C5S	Remote Panel Mount; Full Numeric Keypad; Small Footprint (Typically used for upgrading from the NEMA 1 HIM Bezel)

External and Internal Connections

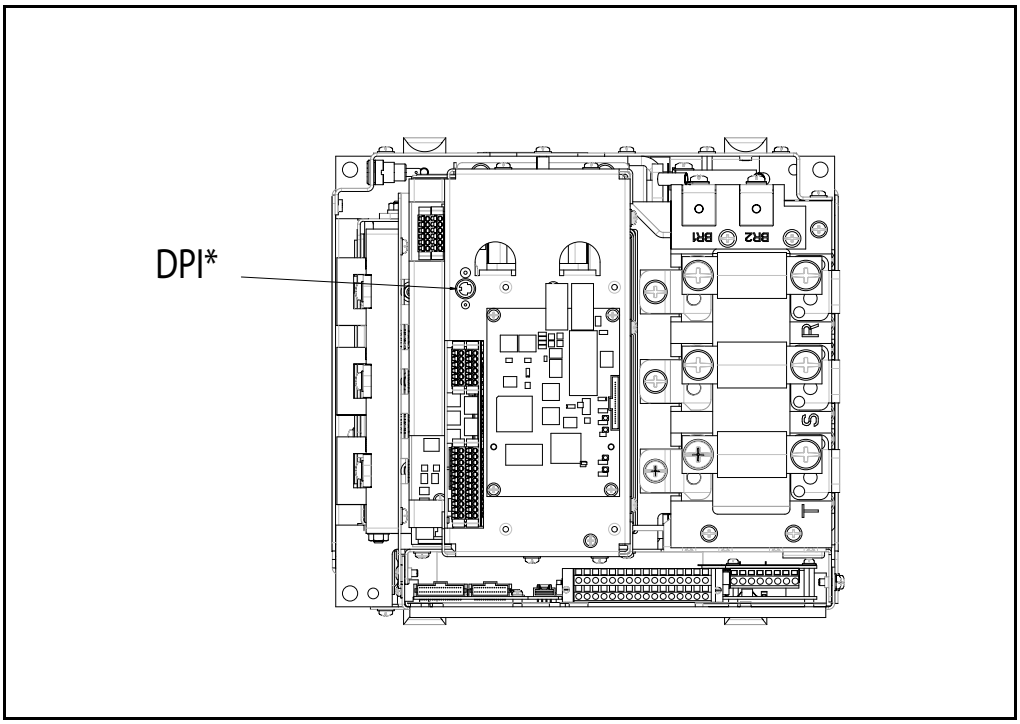
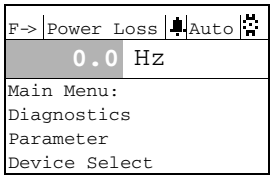


Figure 1.1 –

*If necessary, a DPI port is available for troubleshooting the drive.

LCD Display Elements

Table A.3 – LCD Display Elements

Display	Description
	Direction | Drive Status | Alarm | Auto/Man | Information
	Commanded or Output Frequency
	Programming / Monitoring / Troubleshooting

The top line of the HIM display can be configured with DPI Fdbk Select(299), (Vector firmware 3.xxx and later).

ALT Functions

To use an ALT function, press the ALT key, release it, then press the programming key associated with one of the following functions:

Table A.4 – ALT Key Functions

ALT Key and then...			Performs this function
ALT	Esc	S.M.A.R.T	Displays the S.M.A.R.T. screen.
	Sel	View	Allows the selection of how parameters will be viewed or detailed information about a parameter or component.
	▲	Lang	Displays the language selection screen.
	▼	Auto / Man	Switches between Auto and Manual Modes.
	↵	Remove	Allows HIM removal without causing a fault if the HIM is not the last controlling device and does not have Manual control of the drive.
	.	Exp	Allows value to be entered as an exponent (Not available on Reach Drive).
	+/–	Param #	Allows entry of a parameter number for viewing/editing.

Menu Structure

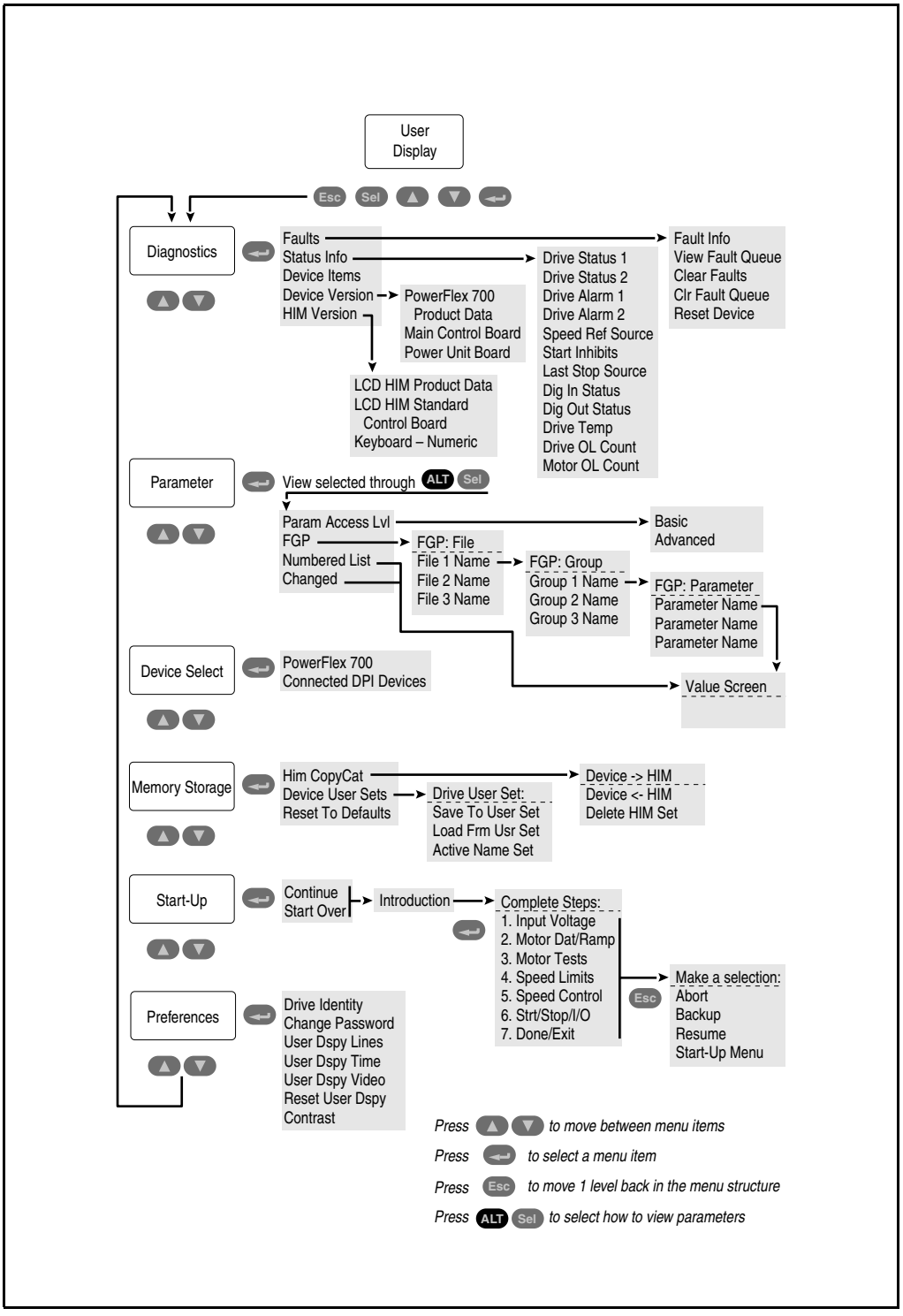


Figure 1.2 – HIM Menu Structure

Diagnostics Menu

When a fault trips the drive, use this menu to access detailed data about the drive.

Table A.5 – Diagnostics Menu

Option	Description
Faults	View fault queue or fault information, clear faults or reset drive.
Status Info	View parameters that display status information about the drive.
Device Version	View the firmware version and hardware series of components.
HIM Version	View the firmware version and hardware series of the HIM.

Parameter Menu

Refer to Viewing and Editing Parameters.

Device Select Menu

Use this menu to access parameters in connected peripheral devices.

Memory Storage Menu

Drive data can be saved to, or recalled from, User and HIM sets.
User sets are files stored in permanent nonvolatile drive memory.
HIM sets are files stored in permanent nonvolatile HIM memory.

Table A.6 – Memory Storage Menu

Option	Description
HIM Copycat Device -> HIM Device <- HIM	Save data to a HIM set, load data from a HIM set to active drive memory or delete a HIM set.
Device User Sets	Save data to a User set, load data from a User set to active drive memory or name a User set.
Reset To Defaults	Restore the drive to its factory-default settings.

Preferences Menu

The HIM and drive have features that you can customize.

Table A.7 – Preferences Menu

Option	Description
Drive Identity	Add text to identify the drive.
Change Password	Enable/disable or modify the password.

Table A.7 – Preferences Menu

Option	Description
User Dspy Lines	Select the display, parameter, scale and text for the User Display. The User Display is two lines of user-defined data that appears when the HIM is not being used for programming.
User Dspy Time	Set the wait time for the User Display or enable/disable it.
User Dspy Video	Select Reverse or Normal video for the Frequency and User Display lines.
Reset User Dspy	Return all the options for the User Display to factory default values.

Table A.8 – View and Editing Parameterts

Step	Key(s)	Example Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to “Parameter.”	▲ or ▼	
2. Press Enter. “FGP File” appears on the top line and the first three files appear below it.	↵	FGP: File Monitor Motor Control Speed Reference
3. Press the Up Arrow or Down Arrow to scroll through the files.	▲ or ▼	
4. Press Enter to select a file. The groups in the file are displayed under it.	↵	FGP: Group Motor Data Torq Attributes Volts per Hertz
5. Repeat steps 3 and 4 to select a group and then a parameter. The parameter value screen will appear.		FGP Parameter Maximum Voltage Maximum Freq Compensation
6. Press Enter to edit the parameter.	↵	
7. Press the Up Arrow or Down Arrow to change the value. If desired, press Sel to move from digit to digit, letter to letter, or bit to bit. The digit or bit that you can change will be highlighted.	▲ or ▼ Sel	FGP: Par 55 Maximum Freq 60.00 Hz 25 <> 400.00
8. Press Enter to save the value. If you want to cancel a change, press Esc.	↵	
9. Press the Up Arrow or Down Arrow to scroll through the parameters in the group, or press Esc to return to the group list.	▲ or ▼ Esc	FGP: Par 55 Maximum Freq 90.00 Hz 25 <> 400.00

Numeric Keypad Shortcut

If using a HIM with a numeric keypad, press the ALT key and the +/– key to access the parameter by typing its number.

Linking Parameters (Vector Control Option Only)

Most parameter values are entered directly by the user. However, certain parameters can be "linked," so the value of one parameter becomes the value of another. For Example: the value of an analog input can be linked to Accel Time 2 (141). Rather than entering an acceleration time directly (via HIM), the link allows the value to change by varying the analog signal. This can provide additional flexibility for advanced applications.

Each link has 2 components:

Source parameter – sender of information.

Destination parameter – receiver of information.

Most parameters can be a source of data for a link, except parameter values that contain an integer representing an ENUM (text choice). These are not allowed, since the integer is not actual data (it represents a value). Table B.6 lists the parameters that can be destinations. All links must be established between equal data types (parameter value formatted in floating point can only source data to a destination parameter value that is also floating point).

Removing/Installing the HIM

The HIM can be removed or installed while the drive is powered.

Important: HIM removal is only permissible in Auto mode. If the HIM is removed while in Manual mode or the HIM is the only remaining control device, a fault will occur

Step	Key(s)	Example Displays
To remove the HIM . . . 1. Press ALT and then Enter (Remove). The Remove HIM confirmation screen appears. 2. Press Enter to confirm that you want to remove the HIM. 3. Remove the HIM from the drive. To install HIM . . . 1. Insert into drive or connect cable.		Remove Op Intrfc: Press Enter to Disconnect Op Intrfc? (Port 1 Control)

APPENDIX D
Application Notes

External Brake Resistor

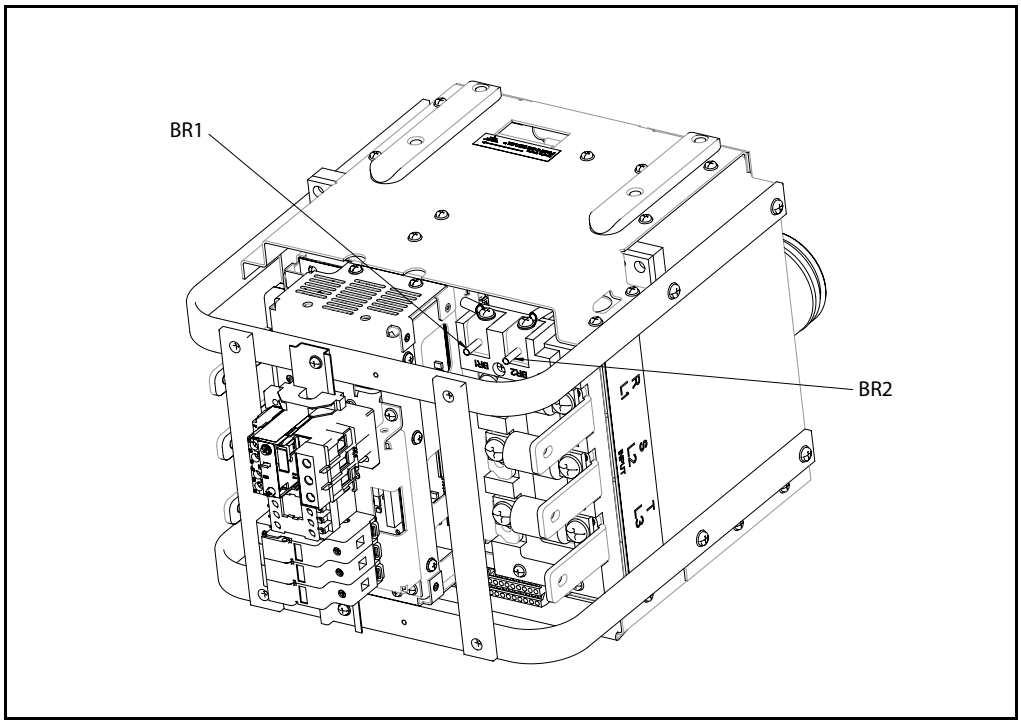


Figure D.1 – External Brake Resistor

Motor Control Technology

There are several motor control technologies:

- Torque Producers
- Torque Controllers
- Speed Regulators

Torque Producers

Volts/Hertz

This technology follows a specific pattern of voltage and frequency output to the motor, regardless of the motor being used. The shape of the V/Hz curve can be controlled a limited amount, but once the shape is determined, the drive output is fixed to those values. Given the fixed values, each motor will react based on its own speed/torque characteristics.

This technology is good for basic centrifugal fan/pump operation and for most multi-motor applications. Torque production is generally good.

Sensorless Vector

This technology combines the basic Volts/Hertz concept with known motor parameters such as Rated FLA, HP, Voltage, stator resistance and flux producing current. Knowledge of the individual motor attached to the drive allows the drive to adjust the output pattern to the motor and load conditions. By identifying motor parameters, the drive can maximize the torque produced in the motor and extend the speed range at which that torque can be produced.

This technology is excellent for applications that require a wider speed range and applications that need maximum possible torque for breakaway, acceleration or overload. Centrifuges, extruders, conveyors and others are candidates.

Torque Controllers

Vector

This technology differs from the two above, because it actually controls or regulates torque. Rather than allowing the motor and load to actually determine the amount of torque produced, Vector technology allows the drive to regulate the torque to a defined value. By independently identifying and controlling both flux and torque currents in the motor, true control of torque is achieved. High bandwidth current regulators remain active with or without encoder feedback to produce outstanding results.

This technology is excellent for those applications where torque control, rather than mere torque production, is key to the success of the process. These include web handling, demanding extruders and lifting applications such as hoists or material handling.

Vector Control can operate in one of two configurations:

1. Encoderless

Not to be confused with Sensorless Vector above, Encoderless Vector y means that a feedback device is <u>not</u> required. Torque control can be achieved across a significant speed range without feedback.

2. Closed Loop (with Encoder)

This industry leading technology allows the drive to control torque over the entire speed range, including zero speed. For those applications that require smooth torque regulation at very low speeds or full torque at zero speed, Closed Loop Vector Control is the answer.

Speed Regulators

The Reach Drives, regardless of their motor control technology (Volts/Hz, Sensorless Vector or Vector) can be set up to regulate speed. Speed regulation and torque regulation must be separated to understand drive operation.

The Reach Drive can offer improved speed regulation by adding speed feedback. Using a speed feedback device (encoder) tightens speed regulation to 0.001% of base speed and extends the speed range to zero speed.

Motor Overload

For single motor applications the drive can be programmed to protect the motor from overload conditions. An electronic thermal overload I^2T function emulates a thermal overload relay. This operation is based on three parameters; Motor NP FLA (42), Motor OL Factor (48) and Motor OL Hertz (47).

Motor NP FLA (42) is multiplied by Motor OL Factor (48) to allow the user to define the continuous level of current allowed by the motor thermal overload. Motor OL Hertz (47) is used to allow the user to adjust the frequency below which the motor overload is derated.

The motor can operate up to 102% of FLA continuously. If the drive had just been activated, it will run at 150% of FLA for 180 seconds. If the motor had been operating at 100% for over 30 minutes, the drive will run at 150% of FLA for 60 seconds. These values assume the drive is operating above Motor OL Hertz (47), and that Motor OL Factor (48) is set to 1.00.

Operation below 100% current causes the temperature calculation to account for motor cooling.

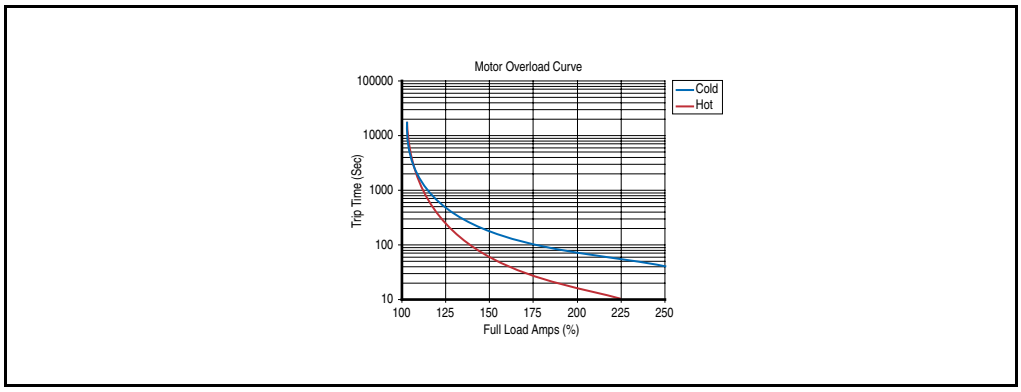


Figure D.2 – Motor Overload Curve

Motor OL Hertz (47) defines the frequency where motor overload capacity derate should begin. The motor overload capacity is reduced when operating below Motor OL Hertz (47). For all settings of Motor OL Hertz (47) other than zero, the overload capacity is reduced to 70% at an output frequency of zero.

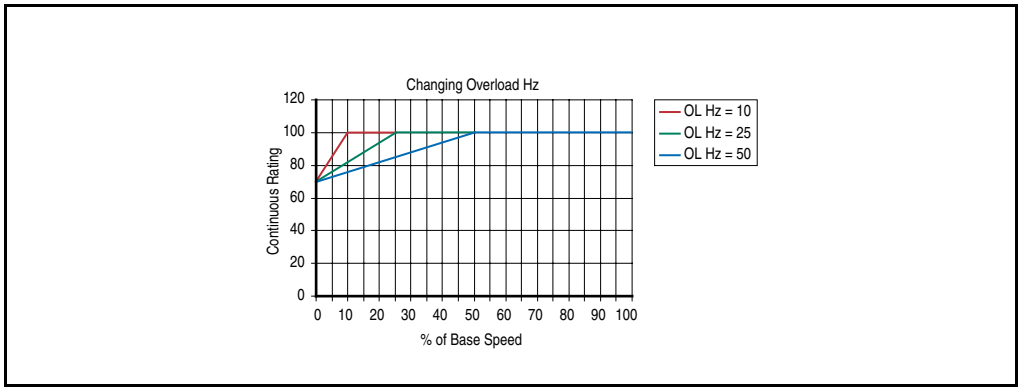


Figure D.3 – Changing Overload Hz

Motor NP FLA (42) is multiplied by Motor OL Factor (48) to select the rated current for the motor thermal overload. This can be used to raise or lower the level of current that will cause the motor thermal overload to trip. The effective overload factor is a combination of Motor OL Hertz (47) and Motor OL Factor (48).

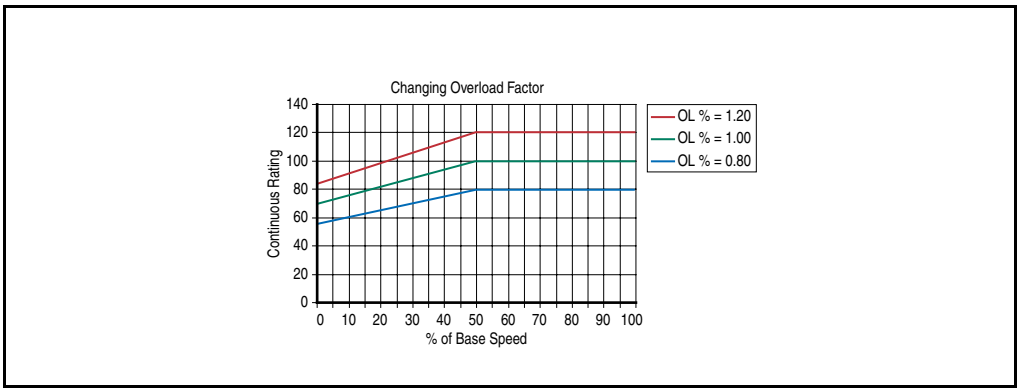


Figure D.4 – Changing Overload Factor

Motor Overload Memory Retention Per 2005 NEC

The Reach Drive (firmware version 4.002 or greater) has the ability to retain motor overload count at power down per the 2005 NEC motor overtemp requirement. To Enable/Disable this feature, refer to the table below. Once Enabled, the value for Testpoint 1 Sel (234) may be changed.

Table D.1 – Overload Retention

Overload Retention	Testpoint 1 Sel (234)	Testpoint 1 Data (235)
Enable	“529”	“529”
Disable	“529”[1]	“0”[1]

[1] Default setting

Overspeed

Overspeed Limit is a user programmable value that allows operation at maximum speed, but also provides an “overspeed band” that will allow a speed regulator such as encoder feedback or slip compensation to increase the output frequency above maximum speed in order to maintain maximum motor speed.

The figure below illustrates a typical Custom V/Hz profile. Minimum Speed is entered in Hertz and determines the lower speed reference limit during normal operation. Maximum Speed is entered in Hertz and determines the upper speed reference limit. The two “Speed” parameters only limit the speed reference and not the output frequency.

The actual output frequency at maximum speed reference is the sum of the speed reference plus “speed adder” components from functions such as slip compensation.

The Overspeed Limit is entered in Hertz and added to Maximum Speed and the sum of the two (Speed Limit) limit the output frequency. This sum (Speed Limit) must is compared to Maximum Frequency and an alarm is initiated which prevents operation if the Speed Limit exceeds Maximum Frequency.

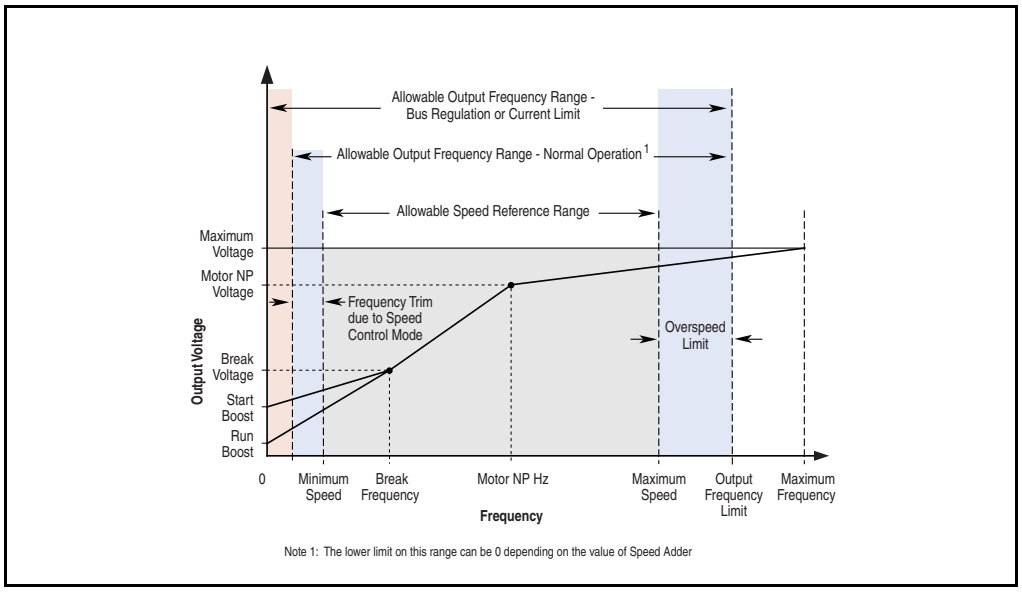


Figure D.5 – Overspeed Limit

Power Loss Ride Through

When AC input power is lost, energy is being supplied to the motor from the DC bus capacitors. The energy from the capacitors is not being replaced (via the AC line), thus, the DC bus voltage will fall rapidly. The drive must detect this fall and react according to the way it is programmed. Two parameters display DC bus voltage:

- DC Bus Voltage (12) - displays the instantaneous value
- DC Bus Memory (13) - displays a 6 minute running average of the voltage.

All drive reactions to power loss are based on DC Bus Memory (13). This averages low and high line conditions and sets the drive to react to the average rather than assumed values. For example, a 480V installation would have a 480V AC line and produce a nominal 648V DC bus. If the drive were to react to a fixed voltage for line loss detect, (i.e. 533V DC), then normal operation would occur for nominal line installations. However, if a lower nominal line voltage of 440V AC was used, then nominal DC bus voltage would be only 594V DC. If the drive were to react to the fixed 533V level (only –10%) for line loss detect, any anomaly might trigger a false line loss detection. Line loss, therefore always uses the 6 minute average for DC bus voltage and detects line loss based on a fixed percentage of that memory. In the same example, the average would be 594V DC instead of 650V DC and the fixed percentage, 27% for “Coast to Stop” and 18% for all others, would allow identical operation regardless of line voltage.

The Reach Drive can selectively use the same percentages or the user can set a trigger point for line loss detect. The adjustable trigger level is set using Power Loss Level (186).

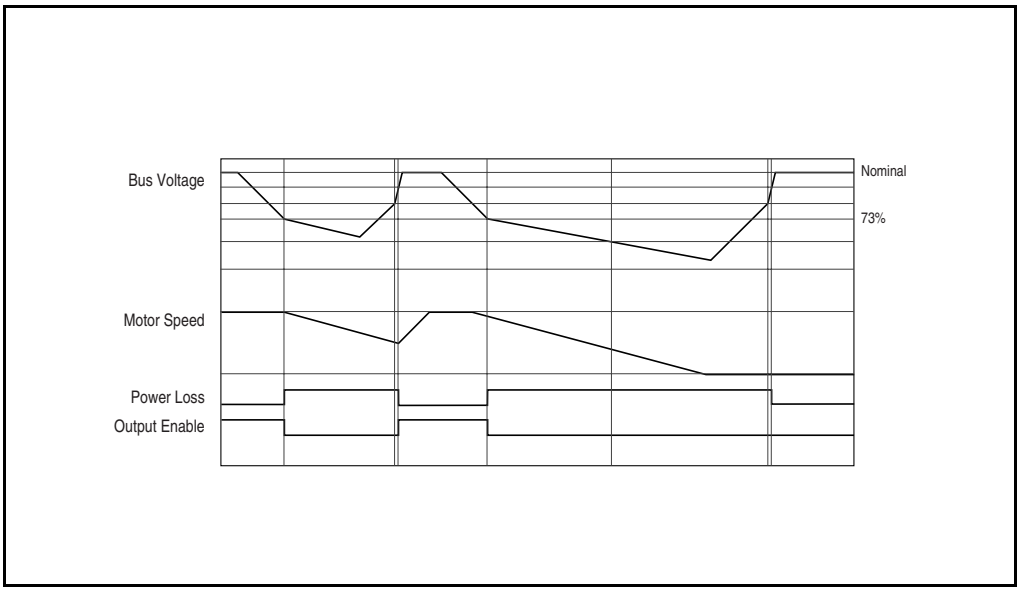


Figure D.6 – Power Loss Mode = Coast

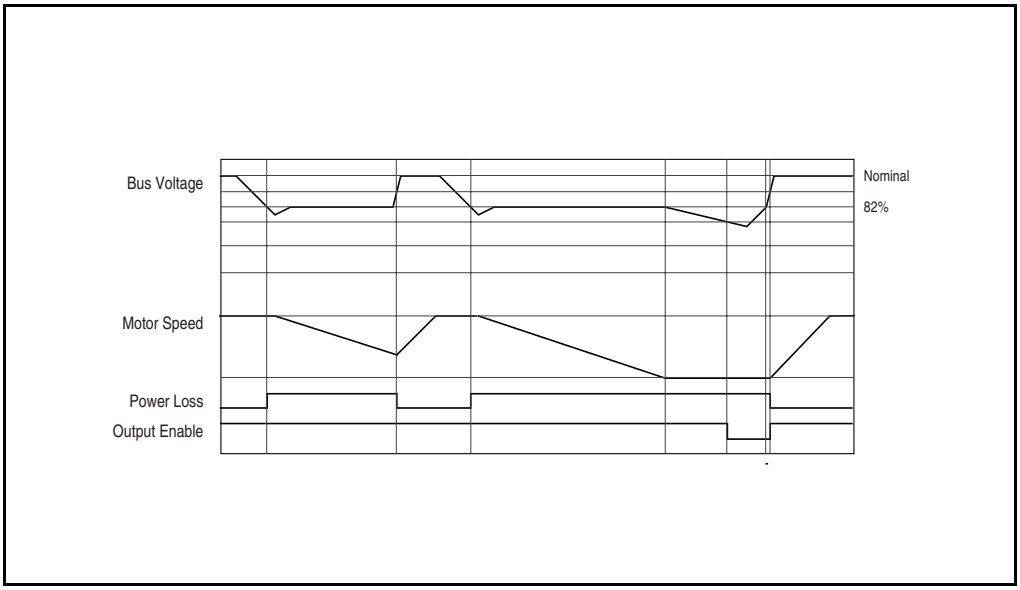


Figure D.7 – Power Loss Mode = Decel

Process PI for Standard Control

The internal PI function of the Reach Drive provides closed loop process control with proportional and integral control action. The function is designed for use in applications that require simple control of a process without external control devices. The PI function allows the microprocessor of the drive to follow a single process control loop.

The PI function reads a process variable input to the drive and compares it to a desired setpoint stored in the drive. The algorithm will then adjust the output of the PI regulator, changing drive output frequency to try and make the process variable equal the setpoint.

It can operate as trim mode by summing the PI loop output with a master speed reference.

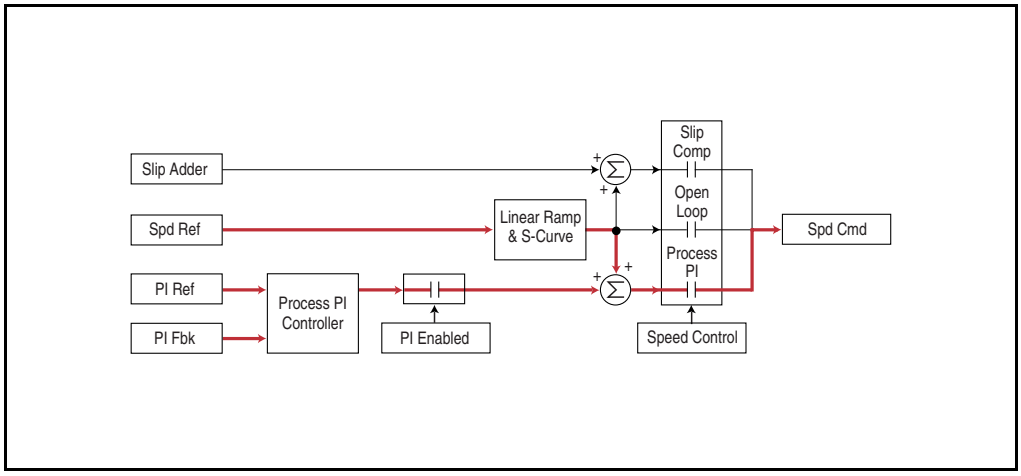


Figure D.8 – Trim Mode

Or, it can operate as control mode by supplying the entire speed reference. This method is identified as “exclusive mode.”

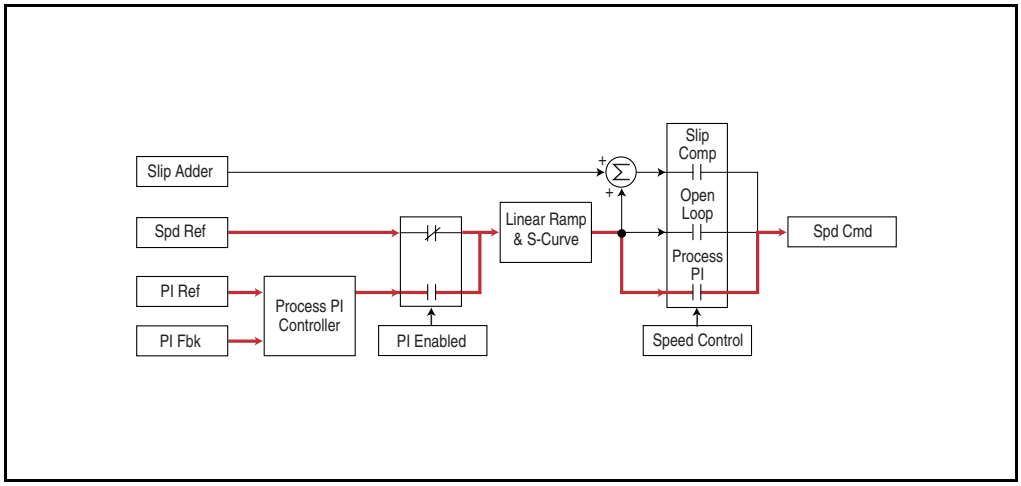


Figure D.9 – Control Mode

PI Enable

The output of the PI loop can be turned on (enabled) or turned off (disabled). This control allows the user to determine when the PI loop is providing part or all of the commanded speed. The logic for enabling the PI loop is shown below.

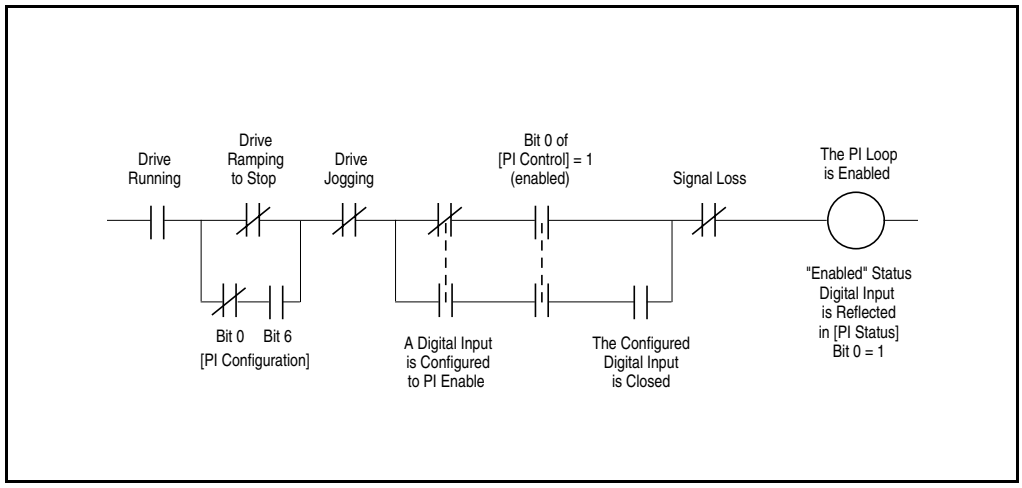

Drive Running
Drive Ramping to Stop
Drive Jogging
Bit 0 of [PI Control] = 1 (enabled)
Signal Loss
The PI Loop is Enabled
Bit 0
Bit 6
[PI Configuration]
A Digital Input is Configured to PI Enable
The Configured Digital Input is Closed
"Enabled" Status Digital Input is Reflected in [PI Status] Bit 0 = 1

Figure D.10 – PI Loop Logic

The drive must be running for the PI loop to be enabled. The loop will be disabled when the drive is ramping to a stop (unless “Stop Mode” is configured in [PI Configuration]), jogging or the signal loss protection for the analog input(s) is sensing a loss of signal.

If a digital input has been configured to “PI Enable,” two events are required to enable the loop: the digital input must be closed AND bit 0 of the PI Control parameter must be = 1.

If no digital input is configured to “PI Enable,” then only the Bit 0 = 1 condition must be met. If the bit is permanently set to a “1”, then the loop will become enabled as soon as the drive goes into “run”.

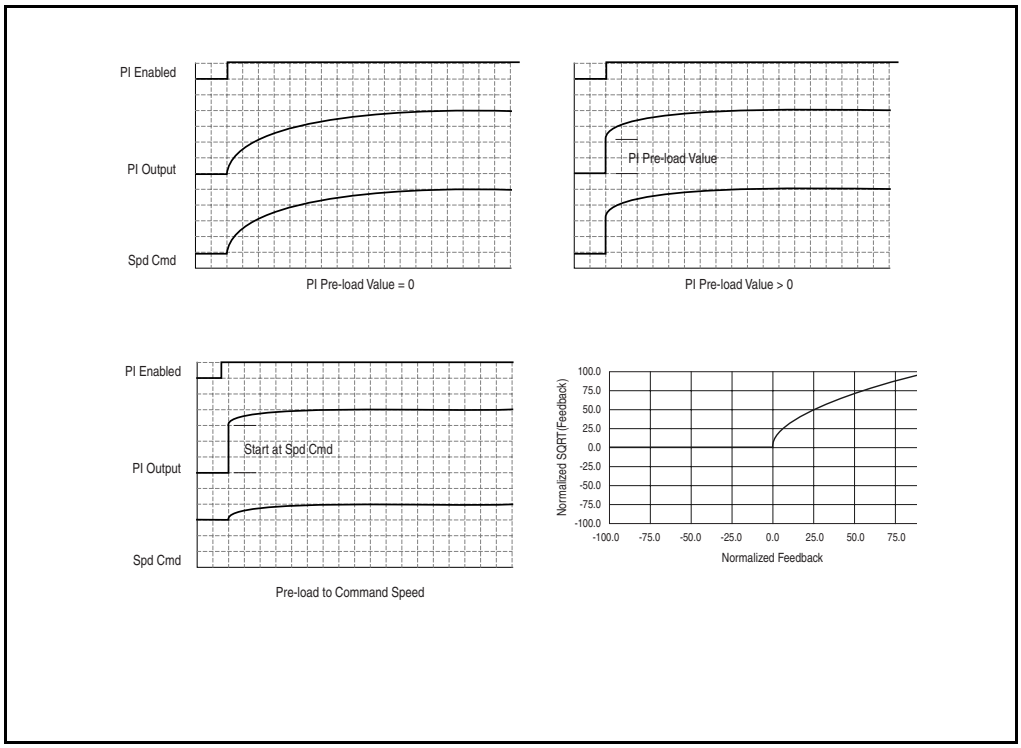


Figure D.11 – PI Enable

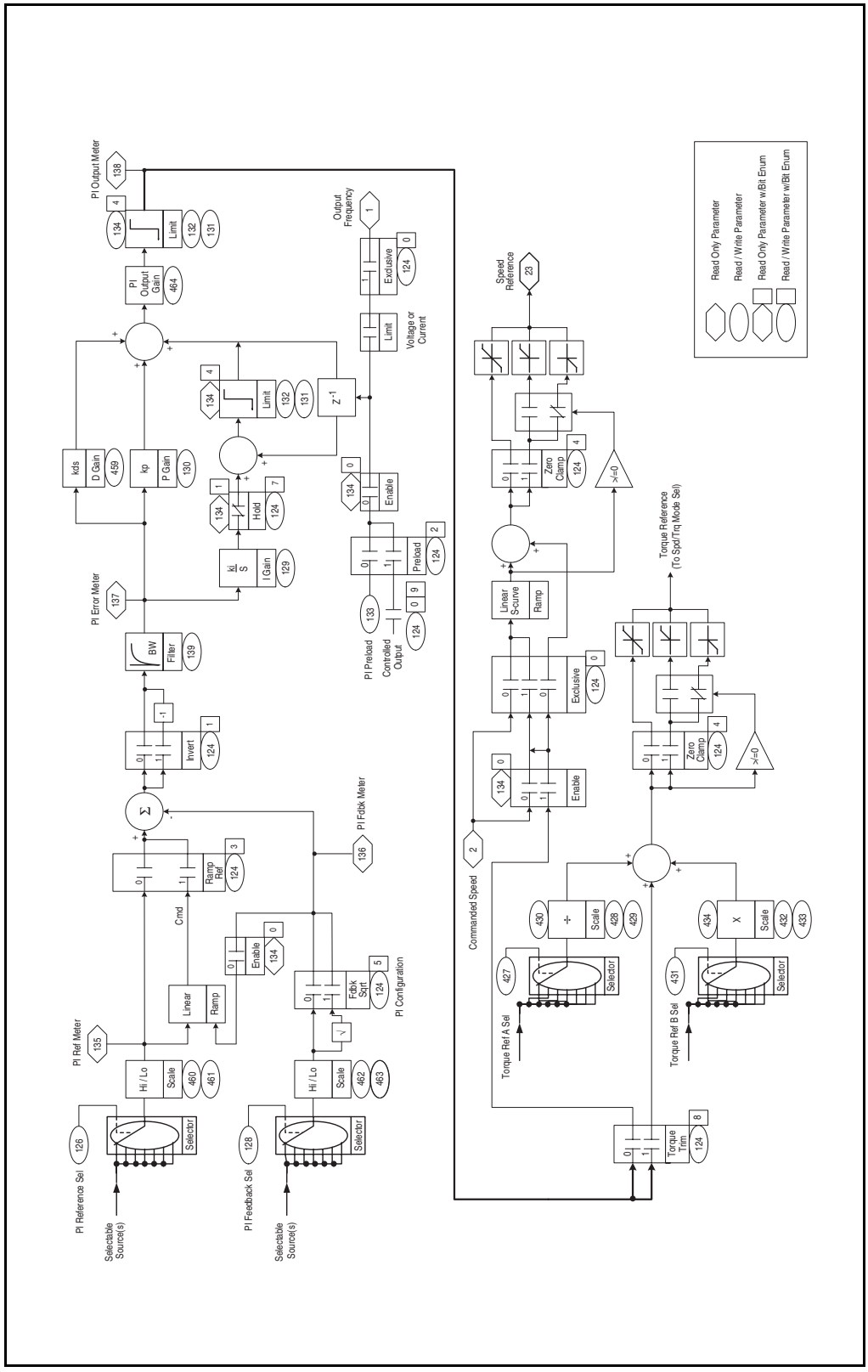


Figure D.12 – Process Trim

Reverse Speed Limit

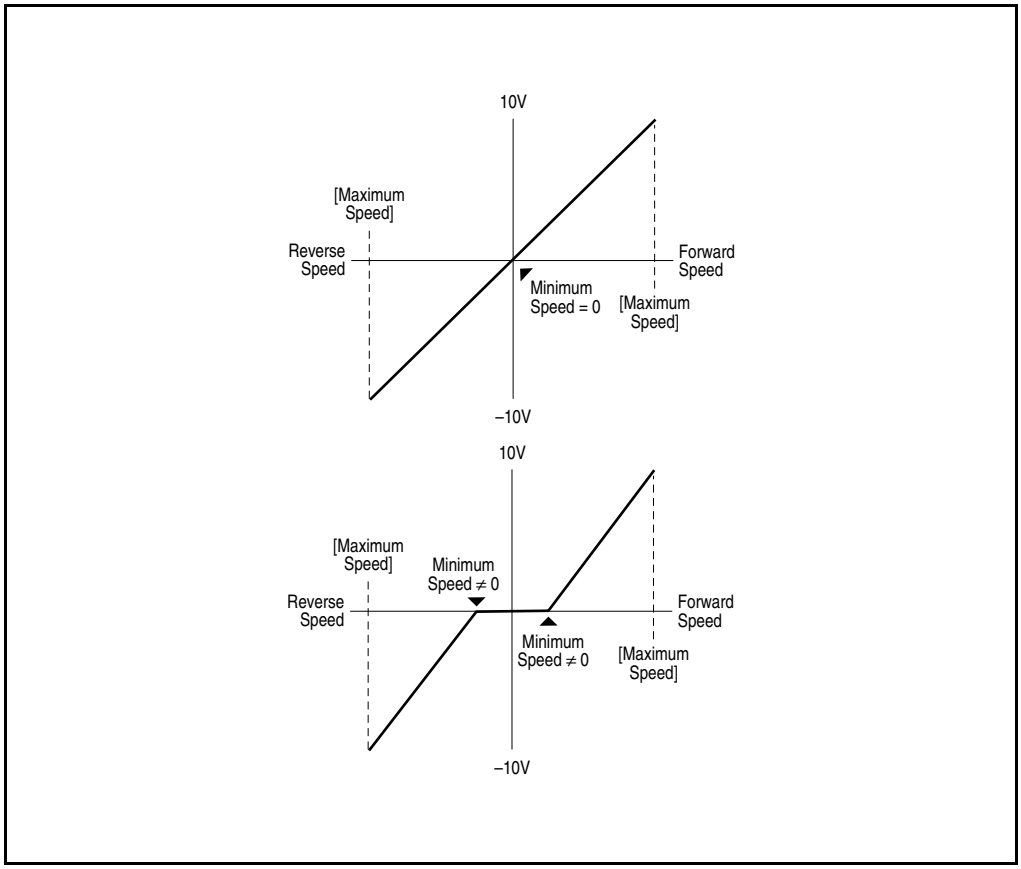


Figure D.13 – Rev Speed Limit (454) Set to Zero

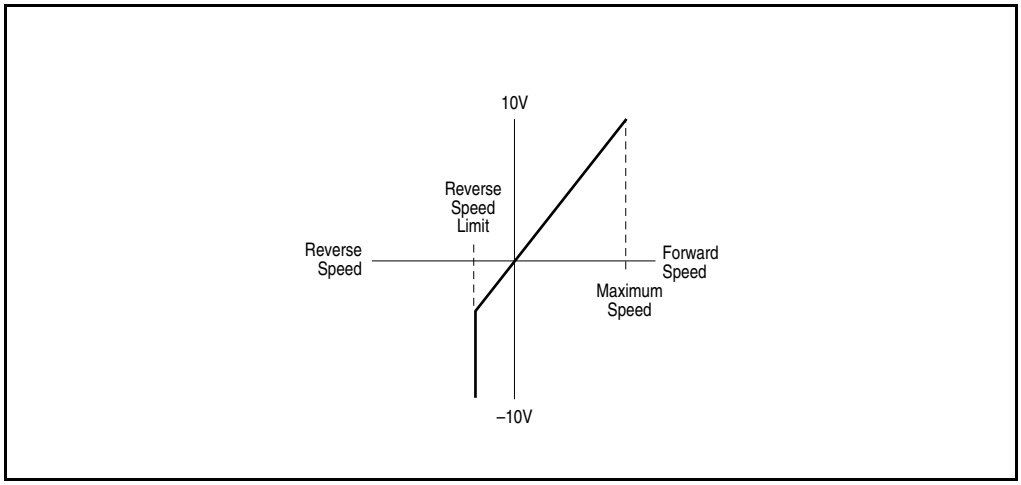


Figure D.14 – Rev Speed Limit (454) Set to a Non-zero Value

Skip Frequency

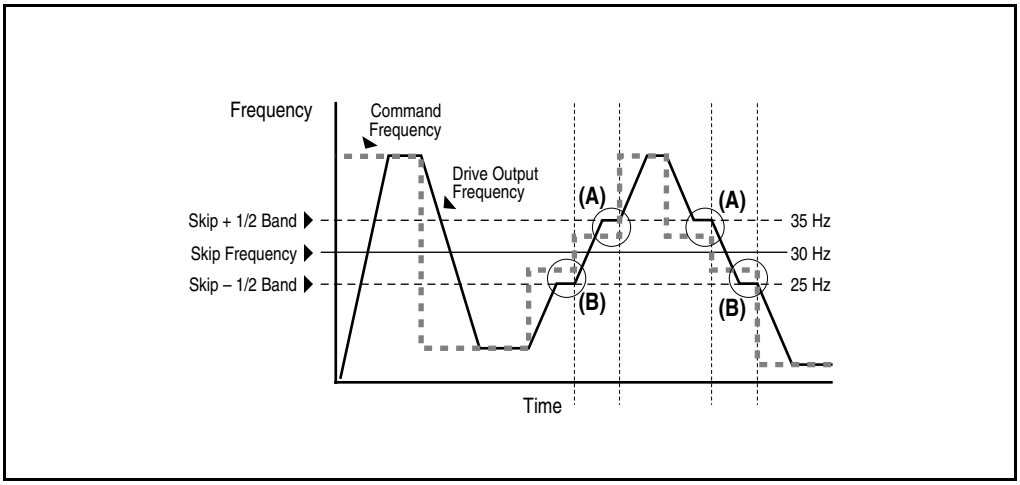


Figure D.15 – Skip Frequency

Some machinery may have a resonant operating frequency that must be avoided to minimize the risk of equipment damage. To assure that the motor cannot continuously operate at one or more of the points, skip frequencies are used. Skip Frequencies (084-086) are available to set the frequencies to be avoided.

The value programmed into the skip frequency parameters sets the center point for an entire “skip band” of frequencies. The width of the band (range of frequency around the center point) is determined by Skip Freq Band (87). The range is split, half above and half below the skip frequency parameter.

If the commanded frequency of the drive is greater than or equal to the skip (center) frequency and less than or equal to the high value of the band (skip plus 1/2 band), the drive will set the output frequency to the high value of the band. See (A) in D.14.

If the commanded frequency is less than the skip (center) frequency and greater than or equal to the low value of the band (skip minus 1/2 band), the drive will set the output frequency to the low value of the band. See (B) in D.14.

Acceleration and deceleration are not affected by the skip frequencies. Normal accel/decel will proceed through the band once the commanded frequency is greater than the skip frequency. See (A) & (B) in D.14. This function affects only continuous operation within the band.

Table D.2 – Skip Frequency Examples

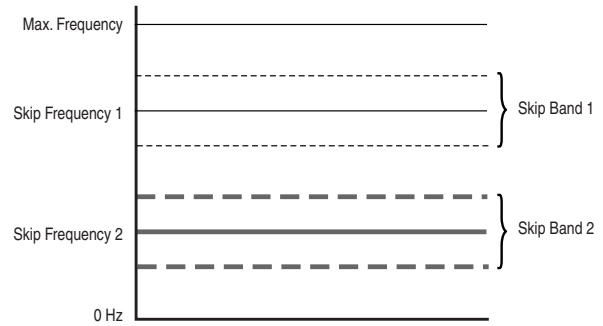
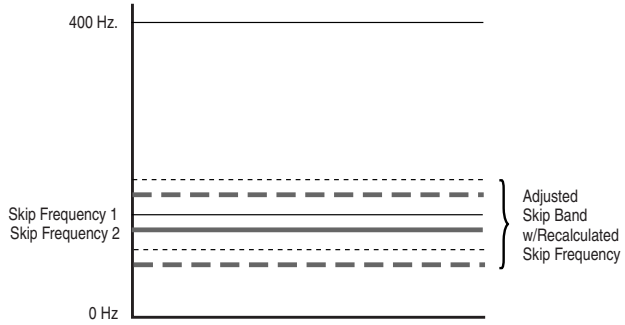
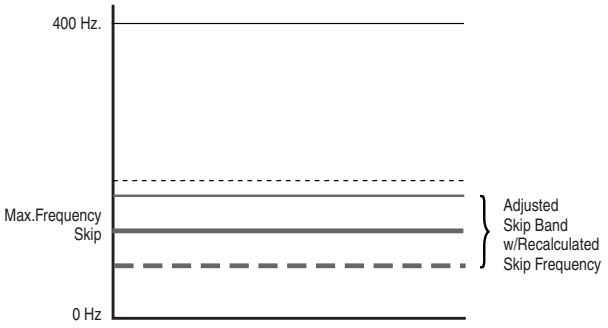
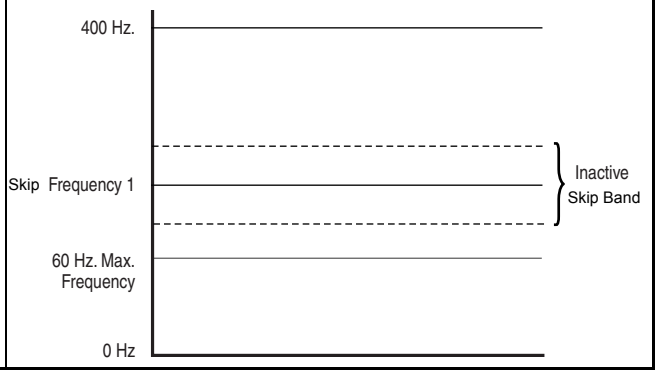
The skip frequency will have hysteresis so the output does not toggle between high and low values. Three distinct bands can be programmed. If none of the skip bands touch or overlap, each band has its own high/low limit.	
If skip bands overlap or touch, the center frequency is recalculated based on the highest and lowest band values.	
If a skip band(s) extend beyond the max frequency limits, the highest band value will be clamped at the max frequency limit. The center frequency is recalculated based on the highest and lowest band values.	

Table D.2 – Skip Frequency Examples

If the band is outside the limits, the skip band is inactive.	

Sleep Wake Mode

ATTENTION: Enabling the Sleep-Wake function can cause unexpected machine operation during the Wake mode. Failure to observe these precautions can result in damage to the equipment and/or personal injury.

This function stops (sleep) and starts (wake) the drive based on separately configurable analog input levels rather than discrete start and stop signals. When enabled in “Direct” mode, the drive will start (wake) when an analog signal is greater than or equal to the user specified Wake Level (180), and stop the drive when an analog signal is less than or equal to the user specified Sleep Level (182). When Sleep Wake is enabled for “Invert” mode[1], the drive will start (wake) when an analog signal is less than or equal to the user specified Wake Level (180), and stop the drive when an analog signal is greater than or equal to the user specified Sleep Level (182)

Definitions

- Wake - A start command generated when the analog input value remains above Wake Level (180) (or below when Invert mode is active) for a time greater than Wake Time (180).
- Sleep - A Stop command generated when the analog input value remains below Sleep Level (182) (or above when Invert mode is active) for a time greater than Sleep Time (182).
- Speed Reference – The active speed command to the drive as selected by drive logic and Speed Ref x Sel.
- Start Command - A command generated by pressing the Start button on the HIM, closing a digital input programmed for Start, Run, Run Forward or Run Reverse.

Refer to D.16.

[1] Invert mode is only available with Vector firmware 3.xxx and later.

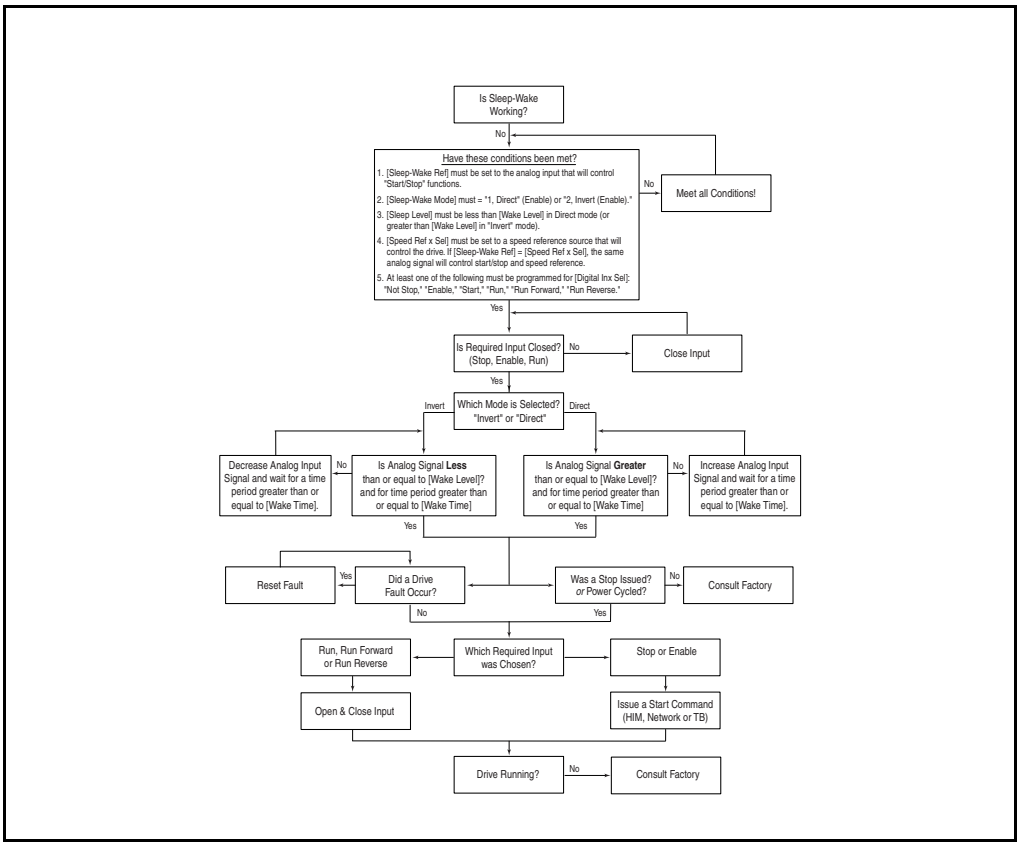

Is Sleep-Wake Working?
No
Have these conditions been met?
1. [Sleep-Wake Ref] must be set to the analog input that will control "Start/Stop" functions.
2. [Sleep-Wake Mode] must = "1, Direct" (Enable) or "2, Invert (Enable)."
3. [Sleep Level] must be less than [Wake Level] in Direct mode (or greater than [Wake Level] in "Invert" mode).
4. [Speed Ref x Sel] must be set to a speed reference source that will control the drive. If [Sleep-Wake Ref] = [Speed Ref x Sel], the same analog signal will control start/stop and speed reference.
5. At least one of the following must be programmed for [Digital Inx Sel]: "Not Stop," "Enable," "Start," "Run," "Run Forward," "Run Reverse."
No
Meet all Conditions!
Yes
Is Required Input Closed? (Stop, Enable, Run)
No
Close Input
Yes
Invert
Which Mode is Selected? "Invert" or "Direct"
Direct
Decrease Analog Input Signal and wait for a time period greater than or equal to [Wake Time].
No
Is Analog Signal Less than or equal to [Wake Level]? and for time period greater than or equal to [Wake Time]
Is Analog Signal Greater than or equal to [Wake Level]? and for time period greater than or equal to [Wake Time]
No
Increase Analog Input Signal and wait for a time period greater than or equal to [Wake Time].
Yes
Yes
Reset Fault
Yes
Did a Drive Fault Occur?
Was a Stop Issued? or Power Cycled?
No
Consult Factory
No
Yes
Run, Run Forward or Run Reverse
Which Required Input was Chosen?
Stop or Enable
Open & Close Input
Issue a Start Command (HIM, Network or TB)
Drive Running?
No
Consult Factory

Figure D.16 – Sleep Wake Mode

Start At PowerUp

ATTENTION: Be aware of the following:

- Setting parameter 168 to 1 (Enabled) immediately applies output power to the motor when all start conditions are met.
- If the drive is running from the terminal block, Start At PowerUp is enabled, and a fault occurs, the drive coasts to rest and generates a fault. In this case, resetting and clearing the fault immediately restarts the drive without any change to the start or stop input states.

When this function is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

Standard Control Option

When Start At Powerup in 2 wire control is configured, the drive will start if the start permissive conditions are met within 10 seconds of drive power being applied. An alarm will be annunciated from application of power until the drive actually starts, indicating the powerup start attempt is in progress. If the drive has not started within the 10 second interval, the powerup start attempt will be terminated.

Vector Control Option

A powerup delay time of up to 30 seconds can be programmed through [Powerup Delay (167). After the time expires, the drive will start if all of the start permissive conditions are met. Before that time, restart is not possible.

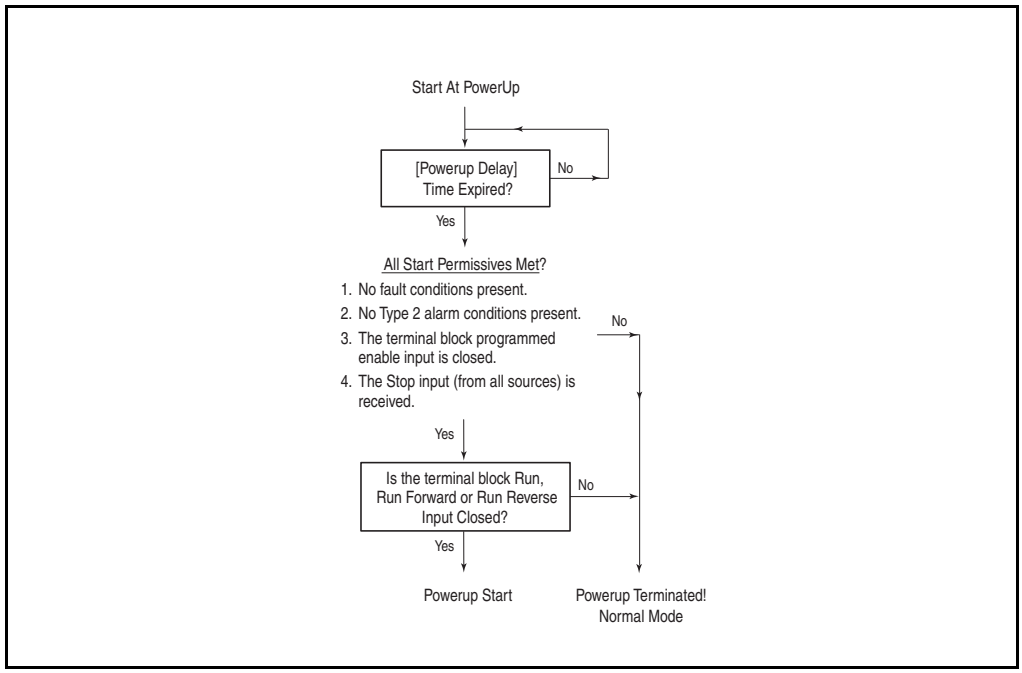

Start At PowerUp
[Powerup Delay] Time Expired?
No
Yes
All Start Permissives Met?
1. No fault conditions present.
2. No Type 2 alarm conditions present.
3. The terminal block programmed enable input is closed.
4. The Stop input (from all sources) is received.
No
Yes
Is the terminal block Run, Run Forward or Run Reverse Input Closed?
No
Yes
Powerup Start
Powerup Terminated! Normal Mode

Figure D.17 – Start at PowerUp

Stop Mode

The Reach Drive offers several methods for stopping a load. The method/mode us defined by Stop/Brk Mode A/B (155 and 156). These modes include:

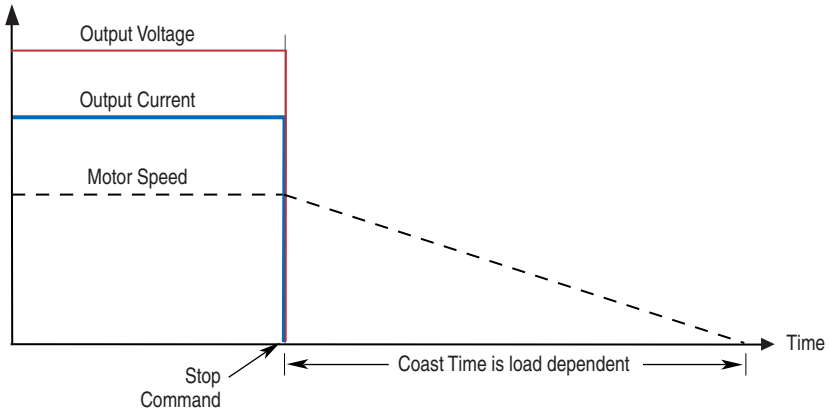
- Coast
- Ramp
- Ramp to Hold
- DC Brake
- Fast Brake

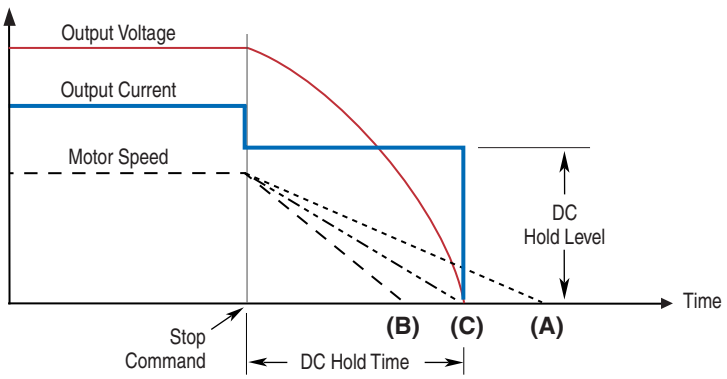
Additionally, Flux Braking (166) can be selected separately to provide addtional braking during a “Stop” command or when reducing the speed command. For “Stop” commands, this will provide additional braking power during “Ramp” or “Ramp to Hold” selections only. If “Fast Brake” or “DC Brake” is used, “Flux Braking” will only be active during speed changes (if enabled).

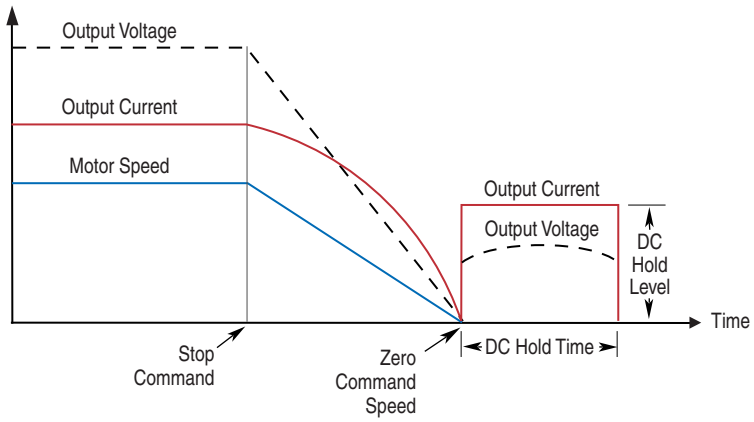
A “Ramp” selection will always provide the fastest stopping time if a method to dissipate the required energy from the DC bus is provided (i.e. resistor brake, regenerative brake, etc.). The alternative braking methods to external brake requirements can be enabled if the stopping time is not as restrictive. Each of these methods will dissipate energy in the motor (use care to avoid motor overheating). Table D.3 describles several braking capability examples.

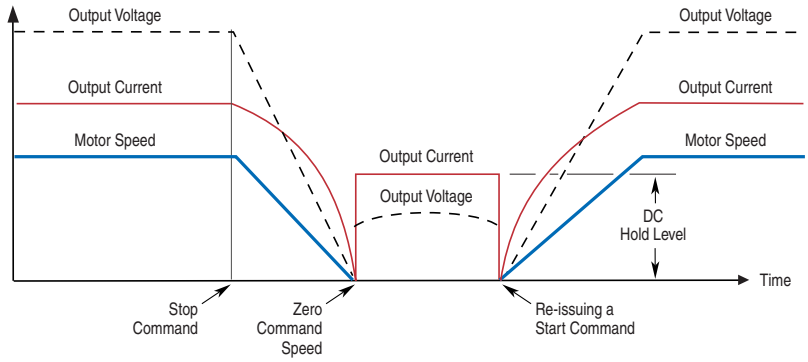
Table D.3 – Braking Method Examples

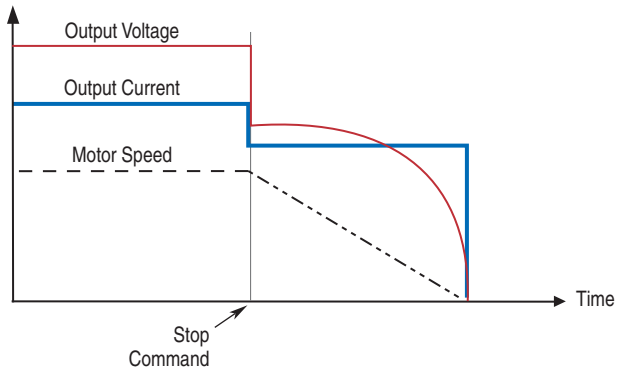
Method	Use When Application Requires...	Braking Power
Ramp	• The fastest stopping time or fastest ramp time for speed changes (external brake resistor or regenerative capability required for ramp times faster than the methods below). • High duty cycles, frequent stops, or speed changes. (The other methods may result in excessive motor heating).	Most
Fast Brake	• Additional braking capability without the use of external brake resistor or regenerative units.	More than Flux Braking or DC Brake
Flux Braking	• Fast speed changes and fast stopping time. • Typical stop from speeds below 50% of base speed (“Flux Braking” will likely stop the load faster than “Fast Brake” in this case.)	More than DC Brake
DC Brake	• Additional braking capability without the use of external brake resistor or regenerative units.	Less than above methods

Mode	Description
Coast to Stop	 This method releases the motor and allows the load to stop by friction. 1. On Stop, the Reach Drive output goes immediately to zero (off). 2. No further power is supplied to the motor. The drive has released control. 3. The motor will coast for a time that is dependent on the mechanics of the system (inertia, friction, etc.).

Mode	Description
Brake to Stop	 This method uses DC injection of the motor to Stop and/or hold the load. 1. On Stop, 3 phase drive output goes to zero (off) 2. Drive outputs DC voltage on the last used phase at the level programmed in DC Brake Level (158). This voltage causes a “stopping” brake torque. If the voltage is applied for a time that is longer than the actual possible stopping time, the remaining time will be used to attempt to hold the motor at zero speed. 3. DC voltage to the motor continues for the amount of time programmed in DC Brake Time (159). Braking ceases after this time expires. 4. After the DC Braking ceases, no further power is supplied to the motor. The motor may or may not be stopped. The drive has released control. 5. The motor, if rotating, will coast from its present speed for a time that is dependent on the mechanics of the system (inertia, friction, etc).

Mode	Description
Ramp to Stop	 This method uses drive output reduction to stop the load. 1. On Stop, drive output will decrease according to the programmed pattern from its present value to zero. The pattern may be linear or squared. The output will decrease to zero at the rate determined by the programmed Maximum Freq (55) and the programmed active Decel Time x. 2. The reduction in output can be limited by other drive factors such as such as bus or current regulation. 3. When the output reaches zero the output is shut off. 4. The motor, if rotating, will coast from its present speed for a time that is dependent on the mechanics of the system (inertia, friction, etc).

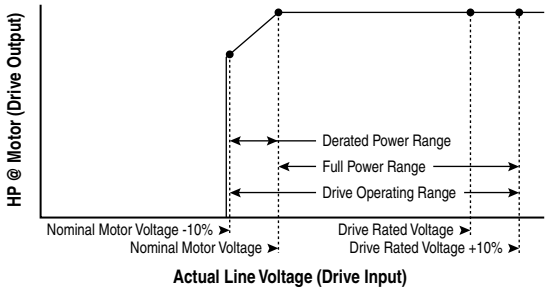
Mode	Description
Ramp to Hold	 This method combines two of the methods above. It uses drive output reduction to stop the load and DC injection to hold the load at zero speed once it has stopped. 1. On Stop, drive output will decrease according to the programmed pattern from its present value to zero. The pattern may be linear or squared. The output will decrease to zero at the rate determined by the programmed Maximum Freq (55) and the programmed active Decel Time x. 2. The reduction in output can be limited by other drive factors such as bus or current regulation. 3. When the output reaches zero 3 phase drive output goes to zero (off) and the drive outputs DC voltage on the last used phase at the level programmed in DC Brake Level (158). This voltage causes a “holding” brake torque. 4. DC voltage to the motor continues until a Start command is reissued or the drive is disabled. 5. If a Start command is reissued, DC Braking ceases and he drive returns to normal AC operation. If an Enable command is removed, the drive enters a “not ready” state until the enable is restored.

Mode	Description
Fast Brake	 This method uses drive output reduction to stop the load. 1. On Stop, the drive output will decrease according to the programmed pattern from its present value to zero at the rate determined by the programmed active Decel Time x. This is accomplished by lowering the output frequency below the motor speed where regeneration will not occur. This causes energy to be lost in the motor. 2. The reduction in output can be limited by other drive factors such as bus or current regulation. 3. When the output reaches very near zero, DC brake will automatically be used to complete the stop whenthe output is shut off.

Voltage Tolerance

Table D.4 – Voltage Tolerance

Drive Rating	Nominal Line Voltage	Nominale Motor Voltage	Drive Full Power Range	Drive Operating Range
380-400	380	380*	380-528	342-528
	400	400	400-528	
	460	460	528	
Drive Full Power Range =	Nominal Motor Voltage to Drive Rated Voltage +10%. Rated power is available across the entire Drive Full Power Range.			
Drive Operating Range =	Lowest (*) Nominal Motor Voltage –10% to Drive Rated Voltage +10%. Drive Output is linearly derated when Actual Line Voltage is less than the Nominal Motor Voltage.			



Example:

Calculate the maximum power of a 5 HP, 460V motor connected to a 480V rated drive supplied with 342V Actual Line Voltage input.

- Actual Line Voltage / Nominal Motor Voltage = 74.3%
- 74.3% × 60 Hz = 44.6 Hz

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